EDITORIAL

"ONLY a small proportion of the Irish have volunteered for service in the British army," a newspaper announces. If a law were passed forbidding them to enlist, the recruiting officers would be swamped with applications.

CONCRETE freight-cars are to be manufactured in Chicago under the supervision of the Federal Railroad Administration. The plans call for a gondola-car containing 6000 lb. of reinforcing-steel, against 30,000 lb. of structural shapes in a steel car of the same capacity.

MANY reinforced concrete ships are being constructed in Norway. The Fougner Concrete Shipbuilding Company of Christiania has 12 sea-going motor-propelled vessels of concrete under construction, ranging in size from 200 to 3000 tons dead-weight. The company has constructed about 25 concrete vessels of all kinds. The favorite type of self-propelled concrete vessel is a 1000-ton ship, 145 feet over-all, 27 feet 6 inches beam, and 15 feet 9 inches molded depth. It is equipped with a 320-horse-power internal-combustion engine, and has four transverse concrete bulkheads.

OF course it's slander but we'll relate it for what it's worth. One of the men employed at a large shipbuilding plant at a Pacific port went to his doctor in a terribly run-down and overworked condition. The doctor told him that he was working too hard and must lay off and rest. "What kind of work do you do that is so hard on you?" the doctor inquired. The man replied, "Well you see Doc, it's this way, I haven't any real job so I always start after something in a hurry whenever a boss comes along and I have to keep running from one place to another all day long to keep busy and that's what wore me out."

TRAINING-SCHOOLS are being conducted by the Oakland Board of Education to enable shipyard workers to learn a trade. Many highly paid 'machinists' are limited in experience to tightening the $\frac{5}{8}$-inch nuts or boring the $\frac{3}{4}$-inch holes, and it is expected that in the readjustment after the War, high wages will not be paid for this class of work. Unrest may follow the forced abandonment of the luxurious style of living to which these workers are becoming accustomed. So it is the aim of the Board of Education to fit as many of the workmen as possible for positions requiring skill and training that they may continue to draw high pay under more competitive conditions. Unfortunately the good work is restricted by a dearth of instructors and hundreds of anxious men are denied the advantages of the course.

TRACK on the San Diego and Arizona railroad has been laid from San Diego east to Jacumba, and from El Centro west to the mouth of Carrizo canyon. From El Centro to Yuma the Southern Pacific lines by way of Calexico are to be followed. The uncompleted part from Jacumba through Carrizo canyon is only 12 miles long, but contains the heaviest work on the entire project, including 17 tunnels. The project has been approved as a war necessity by the Capital Issues Committee. It is expected that the line will be open for travel by March 1, 1919.

ENGINEERS with combustion experience are needed by the Bureau of Oil Conservation, United States Fuel Administration, to act as inspectors of power and industrial plants using fuel-oil and natural gas. An inspector is needed in each of the following districts: Boston, Providence, New York, Philadelphia, Pittsburgh, Buffalo, Detroit, Chicago, Minneapolis, Tulsa, New Orleans, and San Francisco. While men who are in a position to serve without compensation are preferred, the Fuel Administration is prepared to pay a reasonable salary to engineers that cannot afford to give their services.

FREE energy as proposed by Mr. Garabed T. K. Giragossian does not meet with the favor of the Government. A special committee appointed by the Department of the Interior and composed of Messrs. James A. Moyer of the Massachusetts State Board of Education, and Edward F. Miller, M. de Kay Thompson, and Charles L. Norton, of the Massachusetts Institute of Technology, found that the model was not in shape to run or to develop power. The 'inventor' admitted that he had no working machine and that he was merely explaining principles. The members of the committee state that they do not believe that these principles are sound or that the device is operative.

CO-OPERATION between the officials of the California State Mining Bureau and the oil operators of the State has been frequently mentioned in these columns. One form of this co-operation is found in occasional meetings attended by officials, operators, and other interested persons to discuss matters pertaining to the good of the oil industry. The latest of these meetings was held at San Francisco on July 15, the general subject being 'Method of Planning Oilfield Development', and the particular topic, the economical spacing of wells. This spacing depends upon many variables, such as the depth of the territory, the cost of drilling, the life of the property, the price of oil during the life of the prop-

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erty, and the prevailing rates of interest. Since most of these factors can be determined only approximately, the best well-spacing is necessarily largely a matter of individual judgment. The general opinion of the operators present at the meeting was that the number of acres per well should not be less than four nor more than ten.

STANDARDIZATION of screw-threads is the object of an Act of Congress recently approved by the President. A commission of nine is to be appointed, comprising the director of the Bureau of Standards, who is to be chairman, two officers of the Army, to be appointed by the Secretary of War, two officers of the Navy, to be appointed by the Secretary of the Navy, and four members to be appointed by the Secretary of Commerce, two to be chosen from nominations made by the American Society of Mechanical Engineers, and two from nominations made by the Society of Automotive Engineers. The commission is to ascertain and establish standards for adoption in manufacturing plants under control of the War and Navy Departments, and, as far as practicable for general use. The work of the commission will include dimensions and tolerances as well as types of thread.

STANDARD specifications for portland cement in Spanish and English have been issued by the Department of Commerce. Specifications for other structural and engineering materials will be issued from time to time, the next two pamphlets planned dealing with carbon-steel rails and open-hearth girders and tee-rails. These publications will facilitate trade between the United States and Spanish-speaking countries, but there is no intention to force American standards on these countries. These standards have been known and used in Spain and Spanish America for years, but heretofore there have been no authoritative translations. Care has been taken to make the translations thoroughly idiomatic as well as technically correct. Plans are being considered for the publication of specifications in other languages. Such a course cannot fail to have a beneficial effect on foreign trade. Copies of the specifications may be obtained from the Superintendent of Documents at Washington.

A PRIORITY schedule for power has been established for northern California by order of Mr. H. G. Butler, power director appointed by the companies and the State Railroad Commission. As usual, the once mighty, but now despised, breweries receive the brunt of the attack. No new contracts for supplying power to breweries are to be signed and deliveries under old contracts are to be reduced 50%. Beginning August 1, electric advertising signs and window-lights in stores will be allowed only on Saturdays, Sundays, and holidays. Street-car companies that have not already adopted the 'skip-stop' plan are asked to do so, and city officials are to economize on power for street-lighting, even adopting a moonlight schedule if possible. No relief is possible until the fall or winter rains replenish the supply of water for hydro-electric power, and it is likely that further priority orders will be necessary before that time so that the needs of the war industries may be supplied. Such restrictions will certainly be required unless every user of electric energy practices economy.

SUPPLYING unskilled labor, as noted in another column, is now mainly in the hands of the United States Employment Service. The exceptions are as follows: labor that is not directly or indirectly solicited, labor for the railroads, labor for non-war work, labor for establishments whose maximum force does not exceed one hundred, and labor for farms, which latter class is to be recruited by arrangement with the Department of Agriculture. This action has become necessary in order to avert a serious shortage of labor in war industries, which shortage has been aggravated by the practice of 'stealing' or attracting men from one plant to another by the promise of higher wages. This practice has caused a large labor turnover, amounting in some plants to as much as 100% per week. The assignment of quotas will equalize the burden upon each State. It is probable that the system will be extended soon to skilled labor in war industries, and possibly even to labor in non-war industries. However, no attempt will be made to 'conscript' labor, the intention being merely to stabilize the market and to permit laborers as well as soldiers to do their utmost to help win the War.

THE oilfield report for May is the first to be issued by the Pacific Coast Petroleum War Service Committee, and supersedes the monthly reports formerly issued by both the Standard Oil Company and the Independent Producers' Agency. The production was approximately 275,000 barrels per day. The statistics of stocks on hand are arranged in a different form and in more detail than in the old reports. Thus on May 1, field and pipe-line stocks amounted to 22,316,110 barrels of crude oil and 2,988,586 barrels of residuum, refinery stocks to 1,569,174 barrels of crude oil and 1,965,878 barrels of residuum, while there were 7,378,802 barrels of finished and unfinished products at the refineries. On June 1 the corresponding figures were: field and pipe-line crude, 23,976,918; residuum, 2,320,084; refinery crude, 1,102,954; residuum, 1,865,532; refinery products, 6,949,804. The total of all stocks on May 1 was 36,218,550 barrels and on June 1, 36,215,292 barrels, showing that production had practically overtaken consumption for that month at least. It should be remembered, however, that since June 1, California has been called upon to supply the Chilean market with fuel-oil. This means that 600,000 barrels per month, formerly supplied from Mexico, is now being taken from the Californian oilfields. Meanwhile Congress has taken a recess until the latter part of August without passing any measure that will permit the development of the unpatented withdrawn oil-land. The situation is, however, not nearly so bad as it would have been if the operators had not confined development to the more productive territory.

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REVIEW OF THE MONTH

THE fifth year of the War opens with American troops doing a large share of the fighting in France, and American war industries and other war activities, while perhaps not working at the highest possible efficiency, nevertheless making good progress. Tremendous sacrifices and much hard work will still be needed from all of us before the Hun is decisively beaten, but the tide has turned our way. The available man-power and resources of ourselves and our Allies is increasing and will continue to increase, while the man-power and resources of the Central Powers is decreasing and will continue to decrease. Prophecy is dangerous but we may reasonably expect that such gains as the Central Powers may make on any front from this time on will be temporary and relatively unimportant. Probably the most important feature of the events of the past few weeks has been not the splendid victories won or the gallant conduct of the Allied troops, but the fact that so many American troops have now been landed in France, that General Foch has felt justified in taking the offensive.

NOT the least of the War activities in America has been the conservation of food. Whether or not Lord Rhondda actually made the remark attributed to him about the impending defeat of the Allies when he was told that the normal surplus of American wheat had already been exported, there can be no doubt that the food situation in England, France, and Italy early this year was serious. We now have Mr. Hoover's word that, while economy will be necessary until the end of and probably after the War, there is little danger that our Allies will suffer from actual want of food. The export statistics show that while 259,900,000 bushels of wheat and 2,166,500,000 pounds of meat were exported to our Allies during the fiscal year ended June 30, 1917, 340,800,000 bushels of wheat and 3,011,100,000 pounds of meat were exported in the fiscal year ended June 30, 1918. This increase of exports has been accomplished without hardship on our part and at slight inconvenience. Now we have been asked to do something that, while not involving any hardship, will prove inconvenient to most of us, namely, reduce our consumption of sugar to two pounds per capita per month. While this allotment is about one-fourth of the per capita consumption before the War, it is considerably more than the allotment to our Allies, and it must be observed if they are to have even that much. Easy on the sugar and we will make the Kaiser eat crow!

PUBLICITY and its effect on the oil-stock selling 'game' in Denver was discussed a few months ago in these columns There is no blue-sky law in Colorado, but the simple presentation by a city official of the facts regarding some of the so-called oil companies was sufficient to make it impossible to unload more stock on the no longer unsuspecting public. A recent issue of the 'Western Oil World', a publication that has done valiant service in exposing the methods of the stock-selling concerns, tells of a further depression in the business of separating the public from its money, and a consequent increase in the amount available for investment in legitimate development. Selling stock by misrepresenting its value and the nature of the activities of the company issuing it, always has been akin to stealing. At the present time it is a form of treason, since every dollar that can be saved is needed either directly or indirectly to help win the War. Particularly despicable is the attempt to persuade people of small means and smaller business experience to exchange their Liberty Bonds for some worthless or nearly worthless security, and we are glad to see that steps are being taken to place those engaged in this business in their proper place behind the bars of some Federal prison.

EXCHANGING or otherwise disposing of Liberty Bonds is something that should, in general, be discouraged, except when it cannot be avoided. What the Government needs to carry on the War is not so much that the people should subscribe for bonds as that by so doing they should relinquish their claim on a certain part of the products of the entire country, thus permitting these products to be used directly by the Government. Bond issues are simply the most convenient machinery for accomplishing this purpose. If, however, bonds are used to purchase goods, the surplus available for Government uses is correspondingly reduced and the whole object of issuing bonds is defeated. Retain possession of your Liberty Bonds and War Savings Stamps if you possibly can and make every effort to invest the interest in either more bonds or in War Savings Stamps.

JITNEY-BUSSES, like prophets, appear to be without honor in their own country. The city of Los Angeles, where these little pests of the street-car companies first arose, has dealt them what appears to have been a mortal blow. High cost of gasoline and other supplies as well as high wages in the shipyards of San Pedro and Long Beach had diminished the number of drivers until there were only 29 remaining in business a month ago, all of them operating on streets served by car-lines. The Public Utilities Commission, recognizing that such duplication of facilities was a cause of waste, adopted an ordinance prohibiting the operation of automobile-busses on streets served by car-lines. This ordinance presumably

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will have the same effect that similar ordinances have had in other cities, namely, put the jitney-busses out of business. There are few, if any, cities in the United States so poorly provided with street-car facilities that an automobile-buss can be operated at a profit on a five-cent fare basis on streets without car-tracks. In general, the jitney-buss was a product of cheap gasoline and depressed industrial conditions, coupled with the fact that few of the drivers understood depreciation-accounting. Similarly, increased cost of gasoline, the selective draft, and the fact that there is a good job somewhere for practically every one that really wants to work, have made jitney-busses a negligible quantity in most cities and reduced their number elsewhere.

INTERURBAN busses, on the other hand, are increasing, and some of them, at least, must be prospering. There is hardly a section of State highway in California that does not have at least one automobile-stage line running over it, while transportation away from the railroads is done almost entirely by automobile or motor truck. Passenger fares by automobile are usually as low or lower than by train, and the running-time, allowing for the usually greater frequency of stages, is nearly, if not quite as good for distances up to, say, 200 miles. A few years ago there was considerable opposition by the steam-railroad companies to the automobile stages as such, but, after freight and through-passenger traffic increased so much as to tax their facilities, this opposition died down. Now that the Government has taken over the railroads and proclaims frankly that it is doing everything in its power to discourage passenger-traffic, the stage-owners find themselves more popular. The short interurban electric railroads are, of course, still affected seriously by automobile competition. Just what will happen after the War cannot be foreseen, but we may reasonably expect that a large part of the short-haul passenger-traffic will continue to be handled by automobiles. As far as freight and express is concerned, the Pacific Coast has not made such extensive use of motor trucks as have the Eastern States, mainly because it has not been necessary to do so. The existing transportation facilities have been more nearly adequate to the demands upon them than they have been in the East. However, a large part of the short-haul freight-and-express business is passing into the hands of the truck-operators, and the railroad officials seem to regard this development without regret.

HIGHWAY officials, on the other hand, as an article in another column shows, are disposed 'to view with alarm' the increase of motor-truck traffic, particularly the very large trucks that are used by some concerns. Roads that were designed for loads of three or four tons moving at a rate of three miles per hour are going to pieces under loads of ten, fifteen, and even twenty tons, moving at eight to fifteen miles per hour. It is no wonder that Mr. Edwin Duffey, commissioner of highways for New York, wants to prohibit the use of motor trucks of over five tons capacity, which would correspond to a total load of about ten tons. However, although his figures show that the number of the larger trucks is relatively small, even in New York city, the carrying capacity of these larger trucks is about 50% of the total carrying capacity in the city and 20% of the capacity in the remainder of the State. The highway engineers of the country are confronted with the problem that has troubled the railroad engineers for so many years, namely, of strengthening road-bed and bridges for heavy rolling-stock, only to find, in the meantime, that still heavier rolling-stock has been placed in service. Probably the plan suggested by Mr. Charles M. Upham, State highway engineer of Delaware, of regulating the weight of truck according to the character of the road-bed, is the most logical. It is true that we cannot calculate the stresses in a country road, surfaced perhaps with several different materials resting on several different sub-soils, with the same degree of accuracy as the stresses in a bridge, but, with perhaps a little more investigation of bearing on soils, it should be possible to determine whether or not a given weight of truck would be actually dangerous to a given road-surface. Intensity of traffic as well as weight of individual vehicles affects the life of a highway, but this factor would have to be handled by grading license-fees according to weight and the resulting wear upon the highways. Such license-fees would almost certainly be heavier per ton capacity for the larger trucks and might eliminate them automatically. Outside of some of the larger cities and, perhaps for special hauling of ore and lumber where railroad construction is not feasible, the field for the large truck is relatively small. Where a ten-ton is more economical than a five-ton truck, it will usually be found that a freight-car is still more economical.

CONCRETE highways, it is interesting to note, furnish few of the examples of failures cited by the Eastern officials. This is in accordance with experience in California, where the few failures that have occurred have usually been traceable to defective construction. No one would advocate the construction of a four-inch concrete slab in a region where the ground freezes to a considerable depth, but in the mild climate of most of California such a pavement seems to be satisfactory except where the traffic is particularly heavy. So far nothing has occurred to indicate that the type adopted by the California State Highway Commission for most of its work was not the most serviceable, particularly in view of the relatively small amount of money available.

MONEY advanced to railroad companies by the Federal Railroad Administration amounted during June to $36,195,000 to 19 different companies. Of this amount, $16,610,000 was loaned on demand at 6% interest, and the remaining $19,585,000 was paid for rental or compensation. The total amount advanced to July 1 was $160,509,000, of which $18,745,000 was obtained from surplus balances of certain railroads and $141,764,000 from the revolving fund in the United States Treasury.

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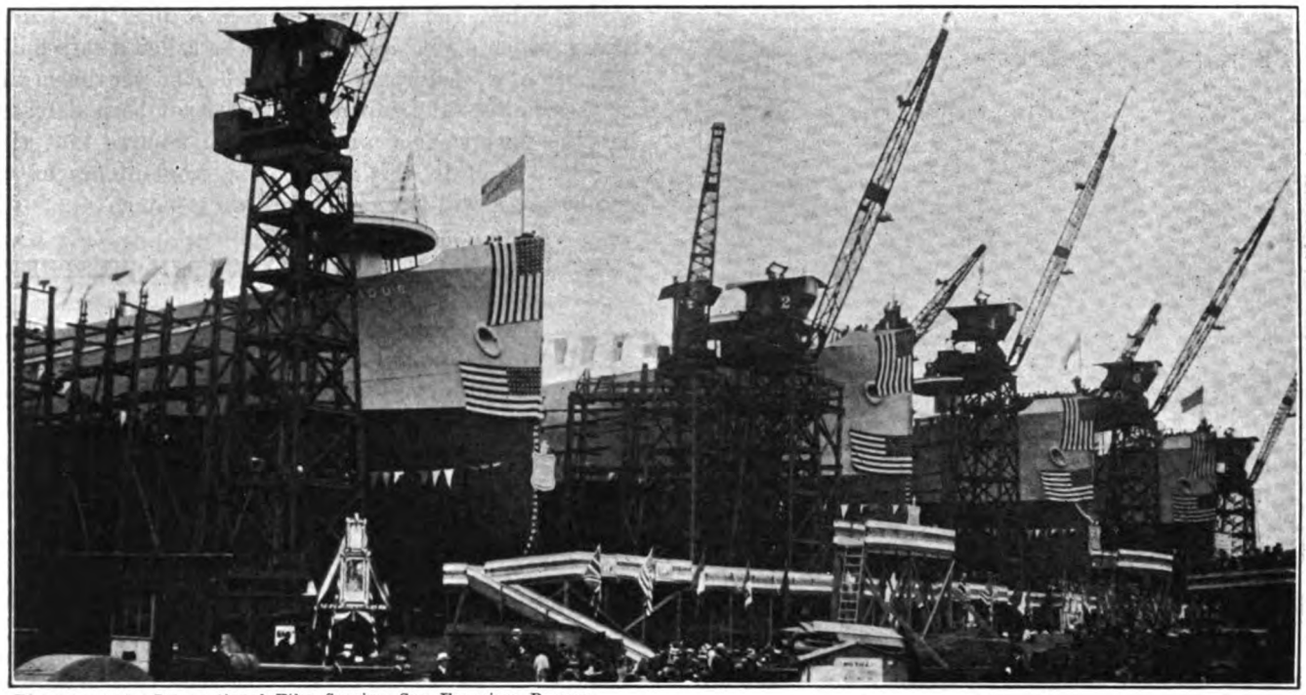

Photograph by International Film Service, San Francisco Bureau

THE 'VICTORIOUS,' 'CHALLENGER,' 'DEFIANCE,' AND 'INDEPENDENCE' AT THE ALAMEDA PLANT OF THE BETHLEHEM SHIPBUILDING CORPORATION

Shipbuilding on the Pacific Coast

The greatest record for ship launchings in the history of the world was made on July 4. In all, 95 ships were sent down the ways on that day in the various yards of the country. It is particularly gratifying to Westerners that more than half of the ships were built on the Pacific Coast. In addition to the honor of launching such a large proportion this coast has the further distinction of having made a clean sweep of the May production honors awarded by the Emergency Fleet Corporation to the plants that excelled in the construction of vessels.

This country is now building ships faster than the submarines are sinking them. Mr. Schwab predicts that this year we will more than treble the output of 1917. It is his expectation that 3,000,000 deadweight tons will be built, the greatest output of any nation in the world in a single year.

Altogether 476,164 deadweight tons of merchant ships were launched on the Fourth. The Pacific Coast yards launched 158,100 tons of steel ships distributed as follows: San Francisco Bay district, 90,300 tons, Oregon-Washington 41,400 tons, and Los Angeles 26,400 tons. In addition to the steel ships the Pacific Coast is credited with 30 wooden vessels. Oregon coming first with 18, Washington next with 10, and California with 2.

The launching in the San Francisco Bay district of eight destroyers and nine freighters was made more notable by the presence of Charles M. Schwab, director, and Charles Piez, vice-president of the Emergency Fleet Corporation. The Schwab party attended the launchings at the Bethlehem and Moore yards and Mrs. Schwab and Mrs. Piez each christened one of the big freighters.

Perhaps the most remarkable event of the day was the launching of the 12,000-ton freighter 'Defiance' at the Alameda plant of the Bethlehem Ship Building Corporation. This vessel was launched in 38 days from the time the keel was laid, a performance 30% better than the launching of the 'Tuckahoe' the 27-day ship. This comparison is based on the amount of steel in the two boats and is considered fair even though not absolutely accurate. Three other 12,000-ton ships were launched from the Bethlehem yard the same morning. At the Moore yard, three 9400-ton refrigerator-ships, the 'Yamhill', 'Yaquina', and 'Guimba' were launched. The 8800-ton ship 'Nantahala' was launched at the Schaw-Batcher and the 5500-ton ship 'Major Wheeler' at the Hanlon yard. Later in the day eight destroyers were launched at the Potrero plant of the Bethlehem company, making a total of 17 ships launched at San Francisco Bay yards.

No sooner had a ship left the ways than the workmen laid the keel-plates for another. Altogether 20 keels were laid in the San Francisco Bay district on July 4. Mr. Schwab drove the first rivet in one of the new keels at the Moore plant, assisted by Charles Piez, vice-president of the Emergency Fleet Corporation as holder on, and by George W. Dickie, as heater. Mr. Dickie, it will be remembered, has the distinction of having built the famous battleship 'Oregon'.

Wonderful as the achievement is, 95 ships launched in

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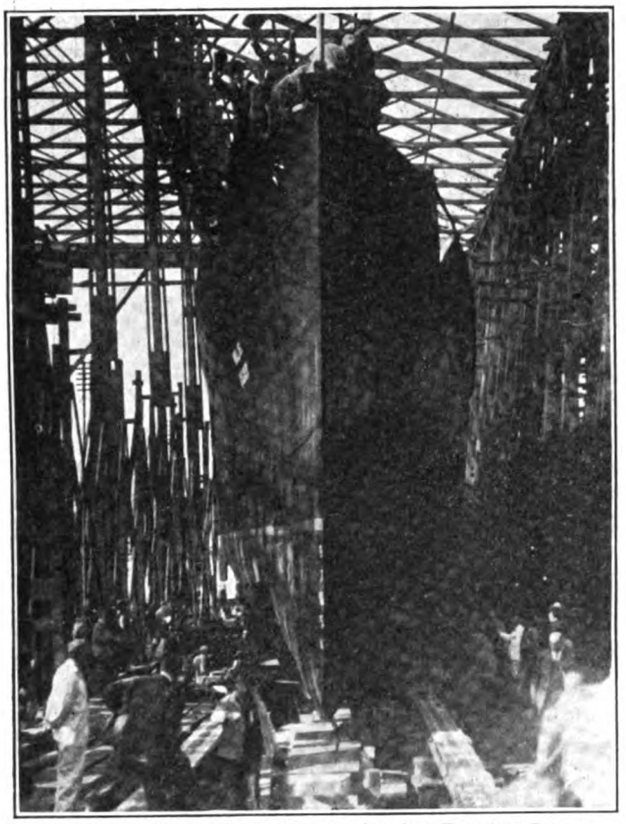
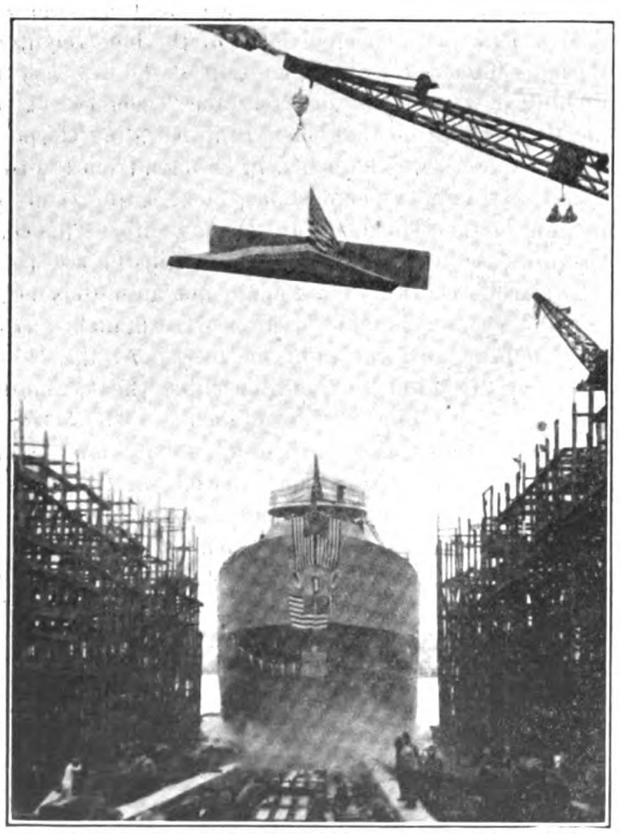


Photograph by International Film Service, San Francisco Bureau

DESTROYER 'MC KEAN' LAUNCHED AT THE POTRERO PLANT, BETHLEHEM SHIPBUILDING CORPORATION



Photograph by International Film Service, San Francisco Bureau

LAUNCHING OF FREIGHT STEAMER 'VICTORIOUS'

a single day, the real significance is that the United States, which a year ago could not be called a ship-building nation, is 'delivering the goods.' And yet this is only the beginning—the submarines have not been defeated, but the performance of the Fourth assures that they will be. And in this defeat, the shipbuilders of the Pacific Coast will have a part second to none.

FEDERAL-AID ROAD-PROJECTS IN WESTERN STATES

Federal-aid road-projects approved by the U. S. Office of Public Roads to April 30, 1918, in Western States, were as follows:

Arizona

Project	County	Miles	Type	Est. cost	Fed. aid
1.	Pinal	1.02	bridge, approaches graveled and oiled	$115,800	$57,900

California

1.	San Mateo	4.24	concrete	70,654	35,327
3.	Contra Costa	2.55	concrete	54,724	25,500
7.	Shasta	16.00	earth	203,132	101,566
8.	Trinity	48.00	earth	510,456	255,228
9.	San Diego	15.00	concrete	373,010	150,000

Idaho

2.	Custer	57.00	earth and gravel	190,410	75,000
3.	Custer	20.00	earth	69,425	23,000
4.	Custer	1.33	earth	8,052	2,000
5.	Lemhi	38.00	earth	299,788	135,000
7.	Custer	18.00	earth	76,034	25,000

Nevada

1.	Humboldt	17.50	gravel	92,189	.....
2.	Nye	14.30	gravel	35,790	.....
3.	Churchill	8.00	sand-clay	57,195	.....
4.	Douglas	4.00	earth and macadam	11,230	.....
5.	Elko	20.00	gravel	97,812	.....
6.	White Pine	12.00	gravel and macadam	62,470	.....

Oregon

4.	Wheeler	9.47	earth	36,733	.....
5.	Union	9.3	earth	36,094	.....
6.	Grant and Wheeler	48.45	earth	400,434	157,217

Utah

1.	Carbon and Duchesne	45.00	earth	77,400	.....
2.	Weber	9.60	macadam	32,818	16,409
4.	Emery and Carbon	63.00	earth	109,923	54,961
5.	Grand	35.00	earth	50,685	.....
6.	Grand and San Juan	24.00	earth	34,756	.....
7.	San Juan	36.00	earth	52,133	.....
8.	San Juan	25.00	earth	36,203	.....

Washington

1.	Thurston	3.52	concrete	61,730	30,865
2.	Mason and Kitsap	9.90	gravel	86,406	41,019
3.	Stevens	5.92	gravel	33,142	16,571
4.	Clarke	3.62	gravel and macadam	78,065	35,000
5.	Cowlitz	5.22	earth	91,194	40,000
6.	Mason	3.41	gravel	47,724	20,000
7.	Lincoln	8.30	gravel and macadam	60,714	28,768

In addition to the roads listed above, several projects in California and Oregon were submitted but either disapproved, canceled, or withdrawn. The record shows, exclusive of the bridge in Pinal county, Arizona, 25.31 miles of concrete road at an estimated cost of $560,118; 9.6 miles of macadam, estimated cost $32,818; 23.92 miles of gravel and macadam, estimated cost, $211,249; 61 miles of earth and macadam or earth and gravel, estiated cost, $201,640; 71.03 miles of gravel, estimated cost, $393,063; and 441.77 miles of earth, estimated cost, $2,092,442; a total of 632.63 miles of roads of all kinds, the estimated cost being $3,491,330. Several projects not included in this list have been submitted to the U. S. Office of Public Roads, and will be considered by the Highways Council.

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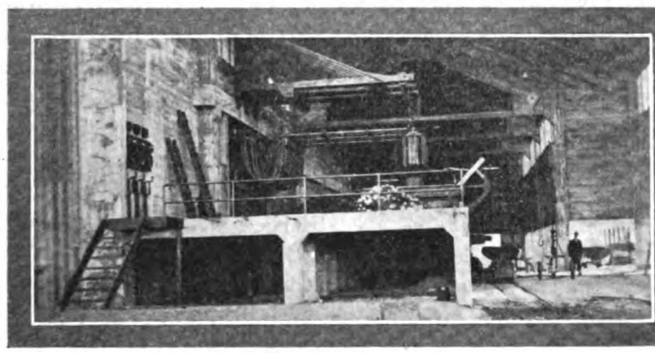
Making Ferro-Manganese in California

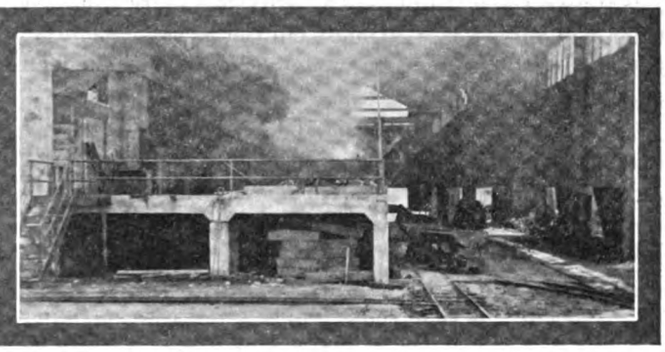
A natural development for the Pacific Coast is that of electro-metallurgy. In California, particularly, there are ores suitable for reduction and water-power available for electric energy, much of it as yet undeveloped. The use of electric furnaces in this State is not new, three having been operated in Shasta county by the Noble Electric Steel Co. for several years. There is a fair demand in the West for alloy metals, but in the East the demand is enormous.

A new company to take advantage of these favorable conditions is the Pacific Electro Metals Co. Its plant is at Bay Point, 30 miles east of San Francisco, on the bay. It is easily accessible, having three railroads close-by, also water transportation. The company is now operating a 40-ton silico-manganese furnace, and will in the near future have a furnace making ferro-manganese. Each of these furnaces has a capacity of 3000 kw. In addition, three 300-kw. furnaces are being erected, in which ferro-nickel, ferro-molybdenum, ferro-chrome, and ferro-tungsten will be made as the raw materials are available. The main buildings are of reinforced concrete. The main furnace building is 120 ft. long and 50 ft. wide. The transformer-building is adjacent to this and is also of concrete. The necessary cooling and packing rooms for the alloys, as well as machine-shop, store-room, wash-house, office, laboratory, and gate-house are all placed in close proximity to the furnace building. The electric furnace in which silico-manganese is made is a three-phase furnace with an open top. The raw materials are fed by shovel around the electrode, and the metal is drawn from a tap-hole at the bottom of the furnace. The operation of smelting is continuous. The electrodes are of 24-in. diameter. The load-factor of an electric furnace should always be good, and the power-factor, owing to the careful interlacing of the leads, is also high. The transformer equipment for one furnace is composed of four single-phase 1000-kw. transformers, one of which is a spare.

To make the plant self-contained and non-dependent on outside sources for electrodes, a plant has been erected and local raw materials are utilized. This building is also of concrete, holding the necessary baking-kiln and apparatus for making electrodes. The directors of the company are C. D. Clarke, San Francisco, president; J. M. Kroyer of Stockton, vice-president; Henry Koster, San Francisco, treasurer; and C. F. Potter and J. W. Beckman of San Francisco. Western capital exclusively is represented in this undertaking. The plant was designed by the Beckman & Linden Engineering Corporation of San Francisco, consulting engineers to the Pacific Electro Metals Company.



PHOTOGRAPH SHOWING LEADS, ELECTRODE, AND ORE OF SILICO-MANGANESE FURNACE, BAY POINT, CALIFORNIA



SILICO-MANGANESE FURNACE IN OPERATION AT BAY POINT, CALIFORNIA

The peat industry in the United States was prosperous in 1917, the quantity of peat sold exceeding that sold in any preceding year. According to statistics compiled by the U. S. Geological Survey, the peat sold in 1917 amounted to 97,363 short tons, a quantity greater by 44,857 tons, or about 85%, than that sold in 1916, and by 42,220 tons, or nearly 77%, than the record annual sales, 55,143 tons, in 1911. The average price received in 1917 at the point of consumption was a little more than $7.29 per ton. The total number of plants was 18, an increase of 5 over 1916, distributed as follows: California, 2; Florida, 2; Illinois, 2; Indiana, 1; Massachusetts, 1; New Jersey, 5; New York, 3; Pennsylvania, 1; and Virginia, 1.

Pure nickel does not rust or oxidize; neither will the metal tarnish like silver or some of the alloys, such as german silver (copper, nickel, zinc). Nickel is practically immune from attacks by alkalies, and is largely resistant to the action of most acids.

Burred and defective hand-tools are on of the most common causes of minor accidents. Foremen and men should see that such tools are removed from service, and put in order.

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The Vocational Re-education of Disabled Men

By C. A. PROSSER*

Congress has delegated to the Federal Board for Vocational Education the duty and privilige of re-educating our disabled soldiers and sailers, and thus rehabilitating them for civil life. Contrary to the usual impression in this country, the crippled man is in a sense the least of the re-education problem. Less than 5% of the men who come back have lost an arm or a leg. Based on the experience of all the belligerents, if there are 1,000,000 men overseas, 1% of them will each year become the subjects of vocational rehabilitation. If we had 1,000,000 men overseas engaged in the sort of warfare through which we are now passing, we would have in a year 10,000 men to be trained. In two years there would be 20,000; in three years 30,000. On the basis of 5,000,000 men we would have 50,000 men per year to be re-educated.

Broadly speaking, of each 10,000 men to be re-educated, 5000 are subjects for medical care alone, and 5000 have had some sort of surgical operation. Of the 5000 surgical cases, approximately 500 will be cases of dismemberment, of these 500, 300 will have lost a leg or legs and 200 will have lost an arm or arms. Contrary to the usual idea, there have been only a few cases of blindness. Out of a total of 41,000 men returned to Canada there have been only 27 blind men.

So this problem as a whole is not a problem of the crippled; it is usually the problem of the man with a complication of troubles, but not the cripple. A man may have a piece of muscle shot away, which will cause him to lose the use of that muscle. He may have a piece of bone shot away from the arm, which will have to be replaced by a piece from one of his ribs. He may have a shot through his knee, giving him a stiff knee. It may be that his leg has been amputated above the knee, and at the same time he may have another wound in the thigh. The surgical injuries run the gamut of such wounds, and the medical cases present almost every possible organic trouble and complication.

There are three steps in the manual activities performed by disabled men under treatment. The first is the bedside occupation. Bedside-occupation work, or ward-occupation work, which is a better term, is done by the men while still in bed or when they begin to walk around the room or go up and down the corridors from one room to another. Its purpose is to employ the time of the men, 'to buck them up,' to hold their attention, and to restore the normal functional activity of any diseased or injured portion of the body. Ward-occupation work is one of the best things that has been developed in modern medicine and surgery.

There follows the period of convalescene, when the man is beginning to recover his strength. He is then taken into the curative workshop, within the hospital. Here he does about the same thing as we give in civilian life as manual training. Its benefits are largely those just described for ward-occupations, only the work is more extensive for the convalescent in the shop. This work can also be used to aid men to discover what they can best do and to give some elementary preparation for the vocational training to follow.

After a man has been discharged from the hospital there begins the more serious job of vocational re-education, and that means utilizing all of the schooling, placements, and co-operative agencies of the country in order to do the work successfully. It is difficult to state what the work will cost. We do not know how many of our men are going to be killed or injured across the seas. That is dependent on the number of men we have over on the other side. It is dependent on what sector of the front they occupy. It is dependent on the extent to which our battalions are absorbed with the British divisions on the Flanders front. It is dependent on how far the Germans are able to push this drive this summer. It is dependent upon our shipping or how fast men can be sent across the seas, and when disabled returned here for treatment.

All these factors are involved in the item of cost. For each 1,000,000 men in service, we may expect 10,000 men to be trained, 5000 of them medical, 5000 of them surgical cases. The figures for Canada indicate that for the entire treatment, functional and vocational, the cost is about $500 per man. However, in this country, the entire cost of the hospital treatment is met by the Surgeon General's Office, and the War-Risk Insurance Bureau pays the compensation of the man while he is under training. The Canadian commission estimates that the cost of vocational rehabilitation will be somewhere between $180 and $200 per man. For 10,000 men, we will have a cost of from $1,800,000 to $2,000,000.

What trades should be taught the cripple? The first requirement is that they be trades in which the local employment-possibilities are good and in which there is a definite demand for a greater number of skilled operatives; that they be not seasonal trades; that they be growing rather than on the wane; and that the wage standards be satisfactory. The best trades for crippled soldiers are not necessarily the most obvious. A special effort should be made to develop some not taught in the regular trade-schools.

The education of the adult consists principally of his working experience; it should not, therefore, be thrown away, but should be conserved and used as a foundation. It would be silly to train a crippled

*Director Federal Board for Vocational Education.

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farmer as a watchmaker when he can be taught the operation of agricultural tractors; to instruct a railroad brakeman in machine-tool work when he can learn telegraphy and still hold a railway job. Some men can be raised a grade or two in their own trades. A competent bricklayer who has lost a leg, after a course in architectural drafting and the interpretation of plans, becomes a job-foreman or an inspector of construction.

The training of disabled soldiers must be thorough. The courses should be too long rather than too short. A crippled man must be amply prepared for the job he is to hold. He will have difficulties enough without the added handicap of insufficient training. For the same reason the experience during the course should duplicate, so far as possible, the conditions and difficulties met in actual employment. Re-educating a disabled adult is a different proposition from the trade preparation of an apprentice. Crippled soldiers as a class, and the rehabilitation system, must not be discredited by slipshod and superficial methods of instruction.

When the training of the crippled soldier is completed there remains the task of finding him a suitable job. This will be easy or difficult in proportion to the thoroughness of his training. But even if easy, the placement should be made with intelligence and discretion. For the man returned from the front the first job is easy to secure, so easy that we should not be misled by superficial indications. The employer is patriotic and anxious to help the crippled soldiers. But when the War shall have been over a few years these motives will no longer be effective.

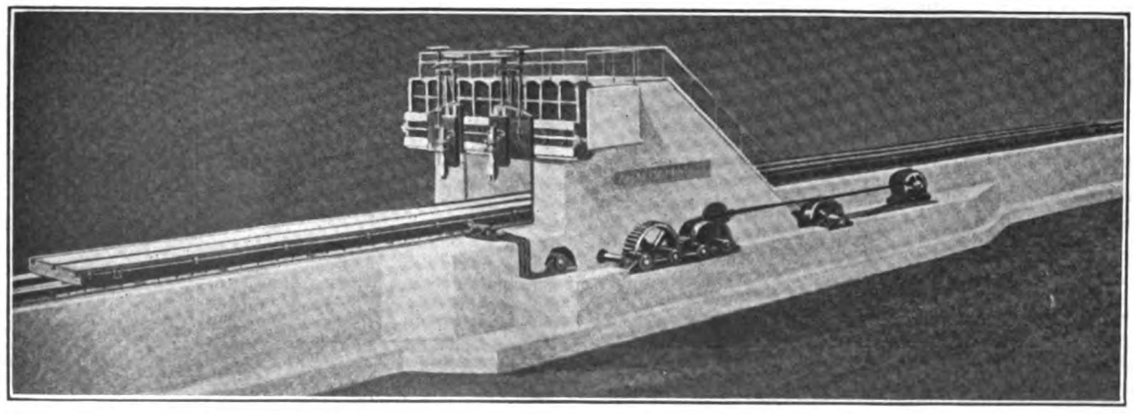
In all branches of the rehabilitation process the attitude of the public can do much to help or to hinder. The man returning disabled from the front deserves the whole-hearted gratitude and respect of the Nation, but to spoil and pamper him is a poor way to meet the obligation. Crippled men testify unanimously that the 'handicap of public opinion' has been a greater obstacle to them than their actual injuries. The public has assumed that they were helpless and only too often have persuaded them to become so. Idleness is a calamity too great to be borne. We must therefore find for the cripple the kind of a job for which he is capable and see that the community influence encourages him to fill it. If we demand that the disabled man return to the work of the world we shall find him only too ready to do so. The cripple that is occupied is handicapped no longer.

A LARGE REINFORCED CONCRETE PLANING-MACHINE

The accompanying illustration, taken from the Journal of the American Society of Mechanical Engineers, shows one of the four planing-machines constructed by the Amalgamated Machinery Corporation, of Chicago, for planing the beds of large gun-boring machines for the Ordnance Department. Each machine has a bed 184 ft. long, 17 ft. wide at the widest point, and is 18 ft. from the bottom of the bed to the top of the housing. Each machine contains 212,000 lb. of iron and steel castings, 500 cu. yd. of concrete, and 34,000 lb. of reinforcing-steel. The bed was designed like a concrete girder.

The bed-ways are made with one flat guide and one V-guide. The ways are made in sections 12 ft. long, 4 ft. 10 in. wide, and 13 in. at the thickest point. The flat guide is 10 in. wide at the top. After the table sections were fastened together, concrete was poured into the box-like sections, making practically a reinforced concrete monolith.

Air-craft production for the War Department to June 8 amounted to 4495 elementary-training planes, 820 advanced-training planes, and 286 combat-planes. The average weekly production of combat-planes in April was 5. For the week ending June 8, it was 80. By June 8, more than 2000 Liberty engines and 37,250 machine-guns for use on aeroplanes had been delivered. During May 900 heavy and 1800 light Browning machine-guns were delivered for all branches of the Army. More than 1,300,000 rifles were produced between April 1917 and June 1918.



REINFORCED CONCRETE PLANING-MACHINE

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Construction of Concrete Ships for Emergency Fleet Corporation*

By R. J. WIG†

Following is a summary of the conclusions of the Concrete-Ship Department.

1. The reinforced concrete ship can be built structurally equal to any steel ship.

2. The available information indicates with all the certainty possible, short of actual experience under service conditions, that the concrete ship will be durable for several years, ensuring satisfactory service throughout the probable duration of the present war.

3. The cost of the reinforced concrete ship complete will vary between $100 and $125 per dead-weight ton, depending upon the number of ships built and the conditions of construction. The cost of the hull alone will be between $30 and $40 per dead-weight ton.

4. The construction of concrete hulls will not interfere with the present program for the construction of steel and wood hulls, in so far as labor or materials are concerned.

5. The Concrete-Ship Department has completed the detailed plans for a 3500-ton concrete ship, so that construction of such ships can start immediately.

6. We estimate that between one hundred and fifty and two hundred 3500-ton concrete hulls can, if we start immediately, be completed by December 31, 1918, (total approximately 600,000 tons).

7. We further estimate that if the construction of yards is begun immediately, and the construction of hulls of 7500 tons each commences by June 1918, 250 can be completed by August 1919.

We believe that we can exceed the above estimate if the necessary machinery can be provided.

Assuming that the above program, which involves the immediate construction of 20 yards with 7 ways each, is started at once, even if for any reason the concrete program should be abandoned after several ships had been given a thorough trial, the actual loss to the Government occasioned by the loss of labor and materials for both ways and ships under construction would not exceed $9,000,000.

The vessel proposed is of the same size, dimensions, and form as the 3500-ton standard wood ship, except that the sheer-line amidships has been altered slightly and no outer keel is fitted. The general arrangement follows closely that of the above wood ship, including the number and position of bulkheads. The propelling machinery designed for the wood ship has been provided for without essential change in this vessel.

The principal characteristics follow:

Length, 268 feet.
Beam over shell, 46 feet.
Depth amidship (at side), 28 feet 3 inches.
Draft, 23 feet 6 inches.
Full-load displacement, 6175 tons.

Comparative Weights in Tons, Concrete, Wood, and Steel Vessels

	Concrete	Wood	Steel
Hull	2,500	2,300	1,160
Fittings, outfit, and equipment	191	191	180
Propelling machinery	206	206	200
Margin	75	80	60
Ship (light)	2,972	2,777	1,600
Reserve feed	80	80	80
Ordnance	23	23	23
Fuel	300	300	300
Stores	40	40	40
Cargo	2,760	2,180	3,057
Total dead-weight	3,203	3,123	3,500
Full-load displacement	6,175	5,900	5,100
Proportion dead-weight to full-load displacement, per cent	52	53	68.6

Metacentric Height. The metacentric heights in the light (ship without cargo) and full-load conditions are, respectively, 2.15 and 2.2 ft. The best practice at the present time places these values between the limits of 1 and 3 ft. for vessels of this type and size.

Range of Stability and Righting Arm. The maximum righting-arm occurs at 51.5° and 46.5° for the vessel light and fully loaded, respectively, the extreme ranges being 89° and 81.5°, respectively.

Freeboard. The freeboard amidships at side is 4 ft. 9 in. This is satisfactory to the representatives of Lloyd's Register of Shipping.

Period of Roll. An attempt to investigate this theoretically is a laborious operation and of doubtful value. It is seldom attempted in the design of steel vessels. It is considered safe to say, however, that the concentration of relatively great weight in the decks and shell in the concrete vessel should aid materially in increasing the period of roll.

Girder Strength or Strength of Vessel as a Whole. The strength of the ship as a girder supported on the crest of a wave amidship, hogging, and also on the crests of two waves, one at each end, sagging, was calculated for five conditions. The same basic assumption as to length, depth, and form of wave and the same method of procedure that is standard practice in calculating the strength of steel ships was followed throughout.

Condition	Maximum bending-moment, foot-tons	Maximum tons per square inch fibre-stress in: Deck-reinforcement	Keel-reinforcement	Lb. per sq. in. fibre-stress in concrete
Ship without cargo, hogging	25,175	5.53	*2.80	728
Ship fully loaded, hogging	37,000	5.63	*2.95	766
Ship without cargo, sagging	14,400	1.28	†2.63	270
Ship light with enough cargo in forward-hole to trim, sagging	11,960	1.07	†2.19	210
Ship fully loaded, sagging	9,400	0.84	†1.72	70

*Keel. †Deck.

*Abstract of special report to Edward N. Hurley, chairman, U. S. Shipping Board, dated April 5, 1918.

†Chief engineer, Department of Concrete-Ship Construction, Emergency Fleet Corporation.

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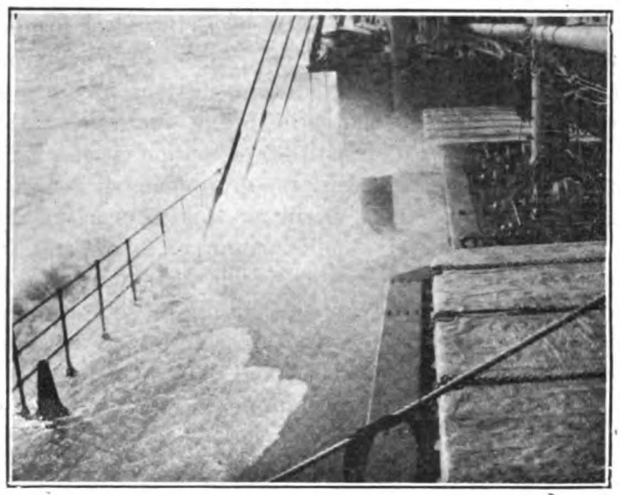
Good practice in steel merchant-ships for a boat of this type gives a maximum stress in the outer fibre of from 5 to 8 tons per square inch, figured on the same basis as given above for the concrete ship. In addition to the stress due to the ship acting as a girder, there is local stress between frames where the plating must act as a beam over that space. This stress is seldom considered in steel ships, but has been computed in the design of the 268-ft. concrete ship.

Transverse Strength. Only for naval vessels is it the practice to compute the transverse strength with accuracy. Either the sizes of frames are taken from the books of the classification societies, or the frames are figured as beams supported or fixed at keel, bilge, or deck, as the case may be. The complete ring in the



CONCRETE SHIP 'FAITH' ON RECENT TRIP FROM SAN FRANCISCO TO SEATTLE

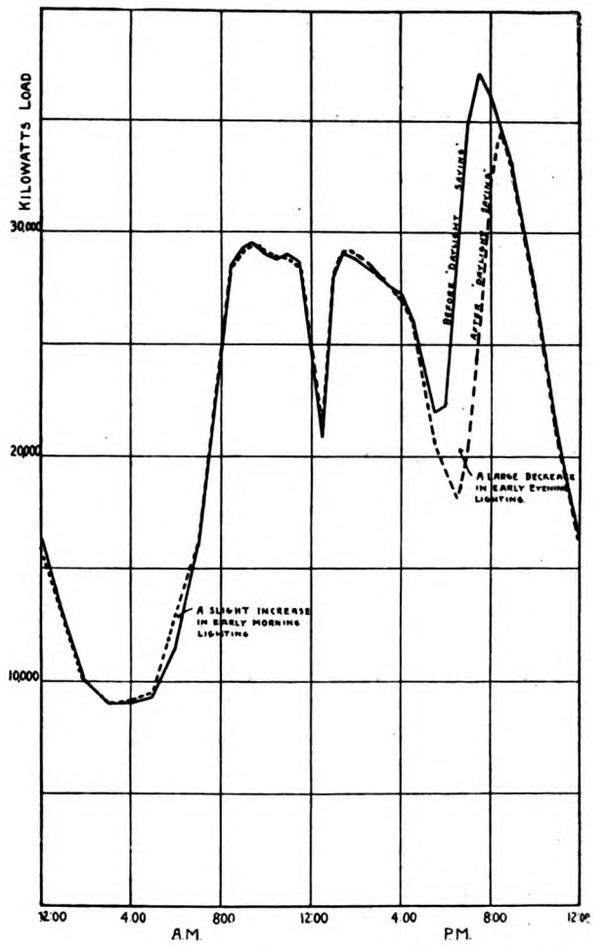
concrete boat is figured with numerous cases of loading and heeling for every frame. The strength of the transverse frames for the vessel was investigated for a large number of conditions of loading and for various immersions of the vessel. The transverse frames are designed to stand the outside water-pressure with water to the gunwales and with minimum cargo-load, for maximum cargo-load and a sagging draft of 16 ft. 6 in., and for listed positions with loading slight and heavy.

Bulkheads. The bulkheads have been designed to carry a head of water on either side to the deck. The collision-bulkheads, fore and aft, were designed for 1500 lb. per square inch in the concrete, and 1600 lb. per square inch in the steel. The steel stress in the engine-room bulkheads was advanced to 20,000 lb. per square inch. In the design of bulkheads for steel ships it is common practice to allow a unit stress in the steel of 22,000 to 23,000 lb. per square inch, so that these assumptions are conservative.

Deck-loads. The deck is designed to carry 5 ft. of water or equivalent, which is in excess of the loading on the decks of standard steel ships being built by this Corporation.

EFFECT OF DAYLIGHT SAVING ON DEMAND FOR ELECTRICAL ENERGY

The accompanying chart, taken from the 'Pacific Service Magazine,' shows average load-curves on the system of the Pacifice Gas & Electric Co. for the week immediately preceding and the week immediately following the adoption of 'daylight-saving.' The large decrease in demand in the evening and the negligible increase in the morning is noticeable. The curves also



LOAD-CURVES

show a decrease in peak-load, but the power companies can take little or no advantage of this condition, since the daylight-saving plan is in force only seven months and they must be prepared for a return to the old load-conditions during the winter months.

Lithium compounds find several important uses; for example, lithium hydroxide is a constituent of the electrolyte of the Edison storage-battery, and other lithium salts are used in pharmaceutical preparations. Metallic lithium, a silver-white soft metal, is the lightest of the alkali metals—so light that it will float on water. Lithium colors a flame deep red, and has been used in fireworks and signal-rockets, and is otherwise of military use.

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Method of Proportioning Concrete-Mixtures Based on the Surface-Areas of the Aggregates

In a paper presented at the annual convention of the American Society for Testing Materials, L. N. Edwards, of Toronto, Canada, describes a series of experiments made by him and advances the theory that the proportion of cement in a given mortar or concrete mixture should depend upon the surface-area of the aggregates. Actual counts were made of the number of grains in samples of several graded sands. The approximate surface-area of the sand-grains in a weighed sample was then computed. A 1:3 mortar of 'standard' Ottawa sand contains one gramme of cement to 13 sq. in. of surface-area of the sand-grains. Tests were made with mortars containing one gramme of cement to 10, 15, 20, and 25 sq. in. of surface-area, respectively. The results, some of which are shown in Fig. 1, indicate that the tensile strength of the mortar varies directly with the proportion between the amount of cement and the surface-area of the sand-grains. The letters J, K, L, M, and N, refer to different kinds of sand. Similar results were obtained for concrete-mixtures.

The mortars to be tested were prepared with a sufficient amount of water to produce a 'normal consistence.' The quantity of water to produce this consistence was determined to be equal to that required to reduce the cement to a normal consistence plus an amount in cubic centimetres equal to the surface-area of the sand in square inches divided by 210. For the sands shown in Fig. 1 and a mixture of one gramme of cement to 10 sq. in. of surface-area, the quantities of cement and water were as follows:

Sand	Surface-area, square inches per 1000 grammes	Cement, grammes	Water, cubic centimetres
J	7151	715	193
K	7301	730	197
L	5745	574	155
M	8811	881	238
N	6498	650	175

The adaptation of the surface-area method of proportioning mortars and concrete both to laboratory investigations and to field construction operations presents no serious difficulties. The outstanding feature of this method, in so far as its practical application is concerned, is the importance of knowing the granulometric composition of the aggregates. Securing this information requires a comparatively small amount of labor, and for equipment only the necessary scales, standard sieves, and screens. The work of determining areas and quantities of cement can be reduced to simple mathematical operations by the use of tables and diagrams.

Fig. 2 and 3 are for determining the surface-areas of sand aggregate. The former is intended for laboratory use and the latter for both laboratory and field use.

Fig. 4 is for determining the surface-area of stone aggregate and is intended for both field and laboratory use. Fig. 5 shows a conversion-diagram for determining

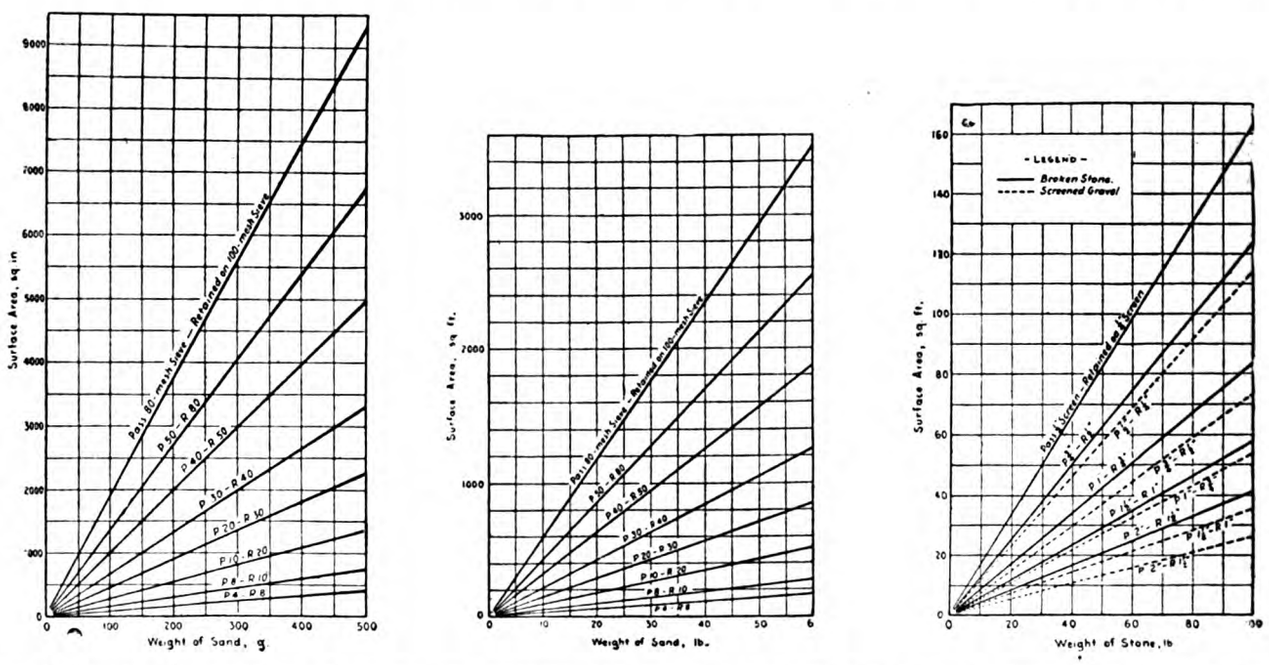

FIG. 2, 3, AND 4. SURFACE-AREAS, SQUARE INCHES, CORRESPONDING TO WEIGHTS IN GRAMMES OF SAND. SURFACE-AREAS, SQUARE FEET, CORRESPONDING TO WEIGHTS IN POUNDS OF SAND. SURFACE-AREAS, SQUARE FEET, CORRESPONDING TO WEIGHTS IN POUNDS OF STONE.

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the relative quantity of cement in pounds per 100 lb. of sand from the corresponding relation of cement in grammes to surface-area of sand. The following examples illustrate the use of the diagrams:

Given a sand of the following mechanical analysis, required to find the amount of cement and water per 1000 gm. for a mixture containing 15 sq. in. of surface-area per gramme of cement.

Sieve					Grading, %	Weight, grammes	Area, square inches
Passing	4-mesh,	retained on	8-mesh	.....	15	150	142
"	8-mesh,	" "	10-mesh	.....	5	50	75
"	10-mesh,	" "	20-mesh	.....	25	250	694
"	20-mesh,	" "	30-mesh	.....	15	150	676
"	30-mesh,	" "	40-mesh	.....	15	150	997
"	40-mesh,	" "	50-mesh	.....	10	100	992
"	50-mesh,	" "	80-mesh	.....	10	100	1348
"	80-mesh,	" "	100-mesh	.....	5	50	932
Total				.....	100	1000	5856

Cement $= \frac{5856}{15} = 390.5$ gm.

Water $= 390.5 \times 22.25\%$ (normal consistence) $+ \frac{5856}{210} = 115$ cc.

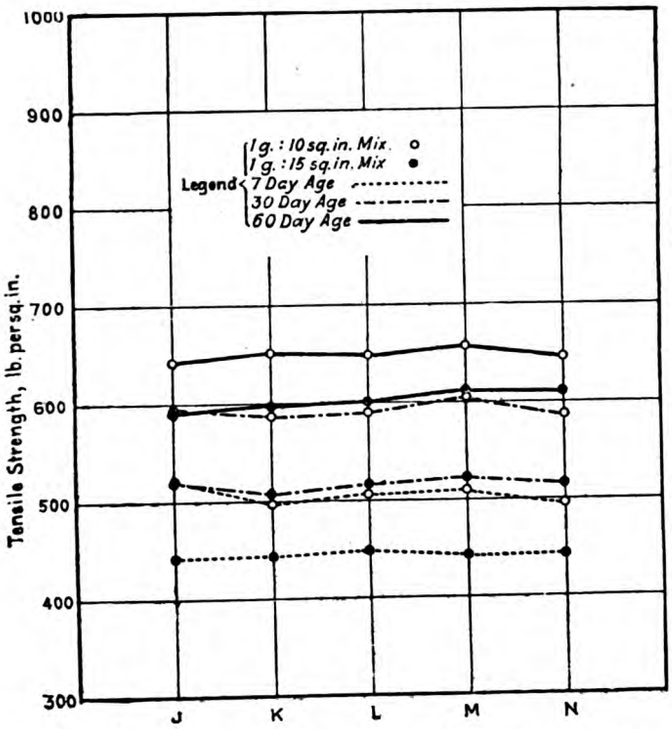

FIG. 1. TENSILE STRENGTH OF MORTAR BRIQUETTES

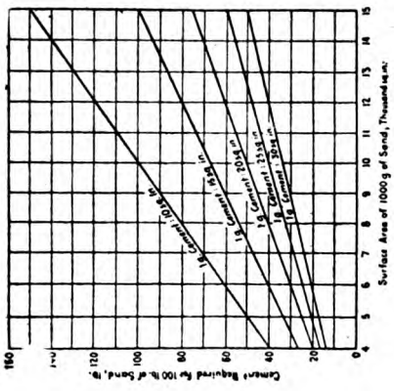

FIG. 5. POUNDS OF CEMENT REQUIRED PER 100 LB. SAND CORRESPONDING TO GIVEN PROPORTIONS AND SURFACE-AREAS.

Required to find the composition of a batch of concrete using 100 lb. of sand, as in the example above, 200 lb. of broken stone graded as shown below, and cement proportioned at a rate of 1 gm. cement to 15 sq. in. aggregate area.

The area of the sand aggregate is determined as shown in the example above except that Fig. 3 is used, therefore: Sand area = 1845 sq. ft. per 100 lb.

Stone Area

Screen					Grading, %	Weight, pounds	Area, square feet
Passing	1½ in.,	retained on	1 in.	.....	60.0	120	69.0
"	1 in.,	" "	¾ in.	.....	25.0	50	41.5
"	¾ in.,	" "	½ in.	.....	10.0	20	24.5
"	½ in.,	" "	¼ in.	.....	5.0	10	16.0
Total				.....	100.0	200	151.0

Total area of aggregates = 1996 sq. ft.
Cement = 19.96 × 2.11 (Fig. 5) = 42.12 lb.

In practice, certain factors, such as the 'dust' in the sand passing the 100-mesh sieve, the difference between laboratory and field methods, and the difference in behavior between coarse and fine sands and also wet and dry sands, will have some effect on the results obtained from mortars and concretes proportioned by the surface-area method, but with the proper allowances these effects should be relatively small.

Time in mixing concrete in machines is usually guessed at by the man in charge. In addition to this, he has the following duties: observe the motive power in a general way, raise and lower the skip without striking careless workmen, supply the proper amount of water for the mixture, and, finally, operate the bucket in placing the concrete. In addition to all these he is expected to guess to a few seconds the time concrete is in the dump. An automatic device, consisting of a small gear-wheel that is worked by the main gear on the machine, a train of small gears, and a gong, has been tried successfully. This batchmeter not only relieves the operator of guessing, but the man in charge knows by the bell that the materials have been sufficiently mixed. One of the most unusual features of this device is the effect produced by the ringing of the bell. It seems to affect the whole organization in that the men in front of the mixer speed up to receive the coming batch; also the men behind the mixer are awakened to the fact that their material should be in the skip in the next few seconds, to prevent delay.

Water has been a great expense to the Old Dominion Co. at Globe, Arizona. As much as 11,500,000 gal. has been pumped in a day. In 1917 the maximum flow was 4,898,393 gal. Pumps installed have a capacity of 20,000,000 gal. daily. It was found in 1916 that below Pinal creek there was an area of exceedingly broken and porous ground near the mine, that probably let in water from the creek. During 1917 a total of 2015 ft. of holes was drilled in the creek-bed, and 23,000 tons of mill slime run into the ground through the holes. When the wet season commences the results of this grouting will be shown.

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The Compression Process for Extracting Natural Gas From Gasoline

The following data have been compiled from Bulletin No. 151, recently issued by the U. S. Bureau of Mines on the 'Recovery of Gasoline from Natural Gas by Compression and Refrigeration,' by W. P. Dykema:

Gas from wells that are being gas-pumped, and are being held under high vacuums, is composed largely of the heavier vapors that would, unless vacuums were used, remain as liquid in the oil. In treating such gas, extreme pressures and temperatures are not necessary. In Eastern fields, where these conditions are most often found, single-stage plants working at a pressure of about 100 lb. per square inch and using such temperatures as can be obtained in submerged coils cooled by the natural temperatures of well or creek waters, give satisfactory recoveries and produce condensates with a gravity and vapor-pressure as high as can be handled, either blended or unblended. In the same fields, however, operators treating gas from old wells not held under vacuum have found that not enough of the vapor carried by the gas can be condensed at pressures lower than 300 lb. to be profitable. The condensate produced at that pressure was exceedingly 'wild,' and in order to effect a maximum saving required blending as early in the process of precipitation as possible. In the newer fields, where the gas is still produced under widely varying rock-pressures, a maximum plant-pressure of 250 lb. is almost universally used, and refrigeration has often been found to increase production from 10 to 50%. Besides the usual cooling with water, at some plants the gas is also cooled in heat interchangers, while still at the maximum pressures used, with expanded gas.

The treatment of natural gas for gasoline is unlike those manufacturing processes in which the treated material may be stored and treated a second or third time after the first extraction or concentration of the desired portions, because the gas, after once coming to the surface, must be kept moving until treated and used as fuel or else wasted to the atmosphere. Marketable fractions of condensate left in the gas after treatment are practically wasted. The gasoline carried in natural gas and precipitated at different points in the treatment consists mostly of pentane and hexane, the fifth and the sixth members of the paraffine series, smaller proportions of heptane, and seventh member, and decreasing percentages, if any, of propane and butane, the third and fourth fractions. The gravity of the plant products as they come to the accumulator or the 'make-tanks' varies between 70° and 96°B., and the vapor-tension, from 5 to 40 lb. The gravity and the vapor-tension of the condensates as collected in the accumulator tanks of the successive stages become higher as the higher pressure and the lower temperature changes are reached. The products range from line-drip or distillate with a gravity of 55°B., produced at atmospheric temperature and pressure, to condensate with a gravity of 105° B., produced in the accumulator tank at the expansion-engine exhaust, at −40°F., the gas having been reduced to a pressure of 10 pounds.

Although some casing-head gasoline is shipped and used without being blended, most of it is mixed or blended with naphtha of lower gravity and vapor-tension before reaching the consumer. Condensate, although at times shipped unblended, is, in the most modern plants and the latest practice, blended as soon as possible after being formed, or even while in the process of precipitation. Some operators ship their product partly blended or reduced in gravity and vapor-tension to blending-stations or refineries, but the general practice is to blend at some stage of precipitation or storage at the plant. Blending at the plants is done in the storage-tanks, the 'make-tanks,' and the accumulator-tanks, and at times in the coils while the condensate is still in process of precipitation and in contact with the high-pressure gas. Operators using these methods claim definite increases in production for each successively earlier point in the process of cooling and precipitation in the high-pressure units at which blending is accomplished. Naphthas having an end point of approximately 400°F. are in general use as blending-stocks, but at some plants where regular supplies of this stock cannot be obtained, distillates having the end point and gravities of kerosene are used. Some blending companies use with the usual naphthas small quantities of 'straight' still-run California gasoline, specific gravity 58°B., and Mid-Continent and Eastern grades, specific gravity 66° to 68°B., in order to increase the proportions of those hydrocarbons in the product.

Since the first commercial gas-compression plants were established, about 15 years ago, in the Eastern oilfields, marked advancement has been made in the mechanical and commercial phases of the natural-gas gasoline industry. Until about five or six years ago, most of the plants consisted of the simplest forms of gas-pumps, single-stage compressors, and cooling-coils, were operated only on rich casing-head gas that would produce 4 to 6 gal. of condensate, and had a capacity of not more than 200,000 or 300,000 cu. ft. per day. At present, plants are in operation treating 6,000,000 to 9,000,000 cu. ft. per day of gas yielding as low as 1 gal. of condensate per 1000 cu. ft., using pressures of 250 and 300 lb. per square inch in two stages of compression, with elaborate systems of cooling the gas with water before compression and after each stage of compression. The water used is cooled below normal temperatures by induced aeration and radiation. In some plants the gas is further cooled by expanding the dry treated gas through the cylinders of an expansion-engine and using the cold expanded gas to cool the high-pressure gas from the water-cooled coils.

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Effect of Heavily Loaded Motor Trucks on Surfaced Highways

A recent issue of 'Public Roads,' the official magazine of the U. S. Office of Public Roads, contains a discussion by several Eastern highway officials of the effect of motor-truck traffic on improved highways and of measures to be taken to protect such highways from deterioration. Freight-car shortages and the increased transportation-needs of the country have caused a great increase in motor-truck traffic, and this increase has been particularly noticeable in the Eastern and Middle Western States. The result has been marked deterioration in the highways, particularly during the spring months, when the frost was coming out of the ground. Roads that have formerly been in excellent condition have become almost impassable.

Edwin Duffey, commissioner of highways for New York, cites a number of instances where water-bound and bituminous macadam highways, constructed in recent years at a cost of $15,000 or more per mile, have failed almost completely under heavy truck traffic, amounting to thirty or more 7-ton trucks per day. To place these highways in good condition will require the practical re-building of the road. Experience in New York indicates that water-bound or bituminous macadam roads will not 'stand up' under a traffic of any considerable number of 5-ton trucks. However, Mr. Duffey believes that either a concrete road, costing about $25,000 per mile, or a bituminous-macadam road 10 to 12 in. thick, constructed by the penetration method and costing $20,000 per mile, can 'stand up' under motor-truck traffic, provided a reasonable limit is placed on the weights of trucks. The reasonable limit Mr. Duffey would apparently place at a truck of 5 tons capacity, although he calls attention to the opinion of many truck-operators that a 3-ton truck is the most economical unit for ordinary service. Mr. Duffey gives the following table of data regarding trucks in service in the State of New York, showing that, outside of the city of New York, less than 7% of the trucks are of a greater capacity than five tons.

Capacity of truck	Registered in New York City	Registered for use outside of New York City
2 tons	15,817	16,547
3 tons	3,963	2,881
4 tons	2,707	1,408
5 tons	2,102	1,081
6 tons	1,610	488
7 tons	1,004	280
8 tons	1,104	292
9 tons	683	115
10 tons	1,261	264
11 tons	953	86
12 tons	455	10
13 tons	116	3
14 tons	79	5
Over 14 tons	85	2
Total	31,939	*23,462

*These include trucks used in the cities of Buffalo, Rochester, Syracuse, Utica, and Albany, as well as in 50 other smaller cities.

J. N. Mackall, chief engineer for the Maryland State Highway Commission, tells the same story of well-constructed water-bound macadam roads and, in some cases, of concrete roads, that have carried the traffic in a satisfactory manner until the past winter and spring, when they failed under heavy motor-truck traffic. In order to place the burden of maintaining the highways upon those users that cause the greatest wear, the Maryland legislature has established the following scale of license-fees per annum:

	Per hp.
Pleasure vehicles	$0.60
1-ton motor-truck	20.00
2-ton motor-truck	40.00
3-ton motor-truck	60.00
4-ton motor-truck	100.00
5-ton motor-truck	150.00
6-ton motor-truck	300.00
7-ton motor-truck	500.00

Mr. Mackall, however, is of the opinion that in addition to these measures a maximum of 10 tons for a loaded truck should be established.

Massachusetts, according to William D. Sohler, chairman of the State Highway Commission, has had much the same experience. To re-build the 2000 miles of main highways in the State so that they could withstand the present motor-truck traffic successfully would cost $60,000,000. Mr. Sohler favors grading the truck license-taxes according to size and a limit of 2½ tons on the capacity of a truck.

A similar story is told by C. J. Bennett, State highway commissioner for Connecticut. Macadam roads have failed under heavy truck-traffic and regulations have been adopted restricting loads on four wheels to 25,000 lb. except when special permission has been obtained from the highway commissioner. At the same time the State Highway Department is replacing water-bound macadam with concrete wherever practicable.

Charles M. Upham, State highway engineer of Delaware, is in favor of co-operation between the Federal government, the State governments, the truck-manufacturers, and the truck-users in solving the problem. He advises assessing license-taxes on trucks according to weight and limitation of the width of trucks. He believes that the use of the trailer will help to solve the concentrated-load problem. He also recommends, when it is known that a certain road should not carry trucks of a given weight, that trucks of this weight be not allowed on the road until it has been improved so as to carry such trucks.

In New Jersey, according to W. G. Thompson, State highway engineer, the deterioration under motor-truck traffic has been particularly severe. The following regulations have been adopted for motor trucks:

Maximum width, over-all	8 ft.
Maximum height	12 ft. 2 in.
Maximum length	26 ft. 6 in.
Maximum weight	30,000 lb.
Number of trailers allowed	1

For future construction of main roads in New Jersey, only concrete foundations will be allowed, 6 to 10 in. thick.

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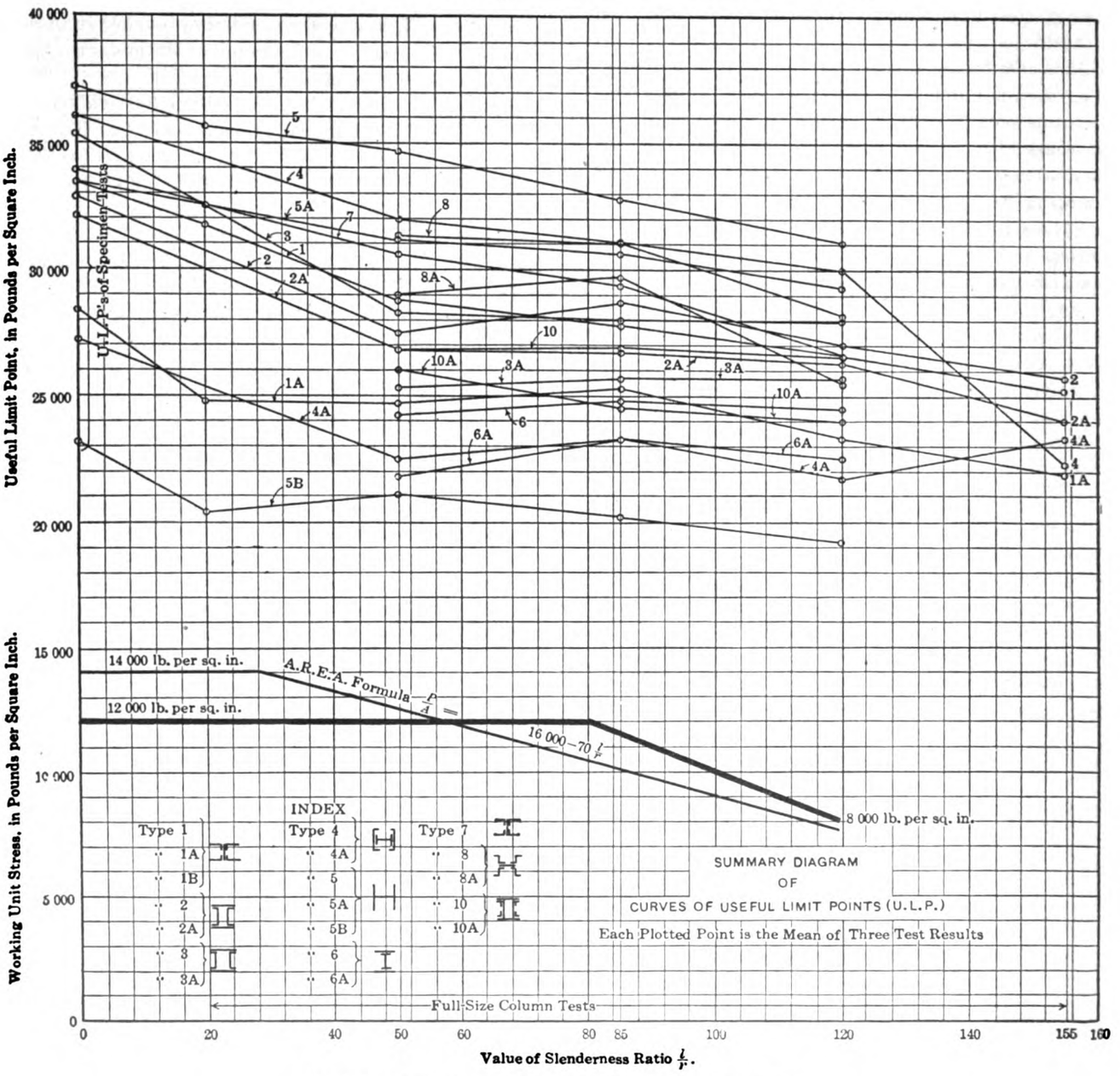
Conditions in the Middle West are discussed by J. L. Harrison, of the U. S. Office of Public Roads. Many failures of macadam roads have been reported. In Wayne county, Michigan, the commissioners have decided to increase the standard thickness of concrete pavement to 9.2 in. at the centre and 7 in. at the sides of an 18-ft. road. The Cleveland-Akron highway carries a heavy traffic, some of the trucks weighing as much as 23 tons loaded. Brick pavement on a 4-in. concrete base and bituminous pavement on a 6-in. concrete base on this highway have both failed almost completely.

RECOMMENDED UNIT-STRESSES IN STEEL COLUMNS AND STRUTS

The accompanying diagram is taken from a report by a special committee of the American Society of Civil Engineers, and shows stresses recommended for different values of $\frac{l}{r}$ both by the American Railway Engineering Association formula and by the formula recommended by the committee.

The average crushing-strength of granites and gneisses used in road-building is between 20,000 and 21,000 lb. per square inch, according to Bulletin 670 of the U. S. Department of Agriculture. The average crushing-strength of limestones and dolomites is between 18,000 and 19,000 lb. per square inch. This bulletin supersedes Bulletin 537 and supplements Bulletin 370, which gave the results of the more common physical tests of approximately 3650 road-building rocks examined before January 1, 1916. Shales and slates should never be used for the wearing-surface of water-bound macadam roads.



WORKING-STRESSES FOR STEEL COLUMNS AND STRUTS

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Splicing Wire Rope*

*Wire rope is susceptible of perfect splicing. A smoother and better splice can be made in this than in manila rope.

Splices for running rope are all known as the long splice, and should be put in from 20 to 50 ft., depending upon size of rope and condition of work. The diameter of the rope is not altered, nor the strength of the rope perceptibly weakened. The accompanying sketches explain splicing in all its stages, and by a little study of them and carefully following the directions any ordinary man can make a successful wire-rope splice. The directions given are for making a 30-ft. splice. When a longer or shorter splice is required, proportionate figures will apply.

In most cases the rope can be applied endless. Where the endless rope cannot be put on, the rope must be placed around the sheaves, drawn tight with tackle-blocks, and the splices made on the spot as in Fig. 1.

The following tools are required: A hammer and a sharp cold-chisel for cutting off ends of strands, a steel point or marlinspike for opening strands, two pieces of heavy tarred marline or thin rope with sticks (Fig. 5) for untwisting rope, a pocket-knife for cutting the hemp core, and a pair of two-pound copper mallets.

(1) Place the rope around the sheaves and draw it to make a 30-ft. splice. A small clamp may be used to prevent the lashing from slipping on the ropes where the blocks are hitched. See that the hopes overlap about 30 ft., about 15 ft. each way from the centre. Then mark the centre of both ropes with a piece of chalk, or by tying on a small string. Proceed to splice, with the blocks remaining taut when it is necessary, but a better way is to remove the blocks, throw off the rope from the sheaves, let it hang loose on the shaft, and then proceed with the splices on the ground or floor, or scaffold, as taut with a pair of tackle-blocks (Fig. 1). The blocks should be hitched far enough apart to give room between the case may be.

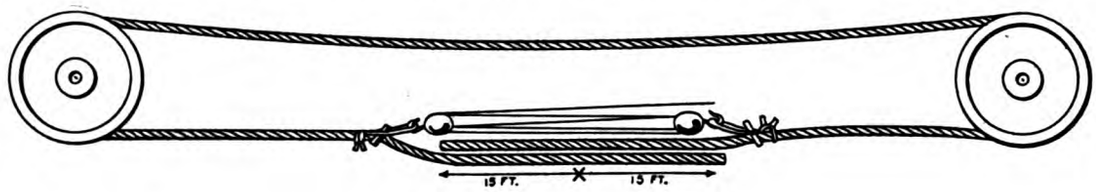

FIG. 1

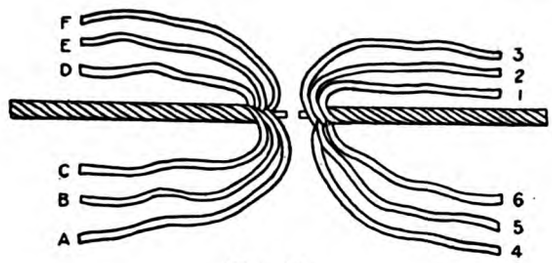

FIG. 2

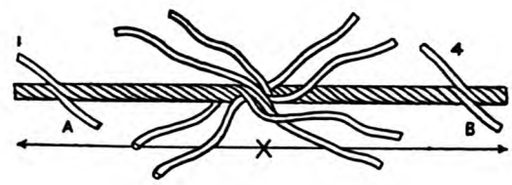

FIG. 3

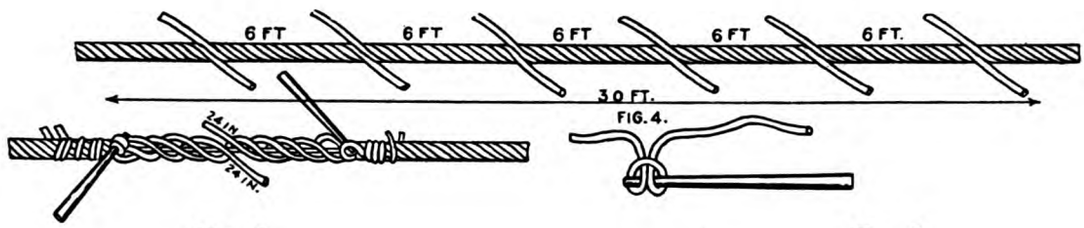

FIG. 5 FIG. 6

(2) Unlay the strand of both ends of the rope for a distance of 15 ft. each, or to the centre strand of both ends of the rope for a distance of 15 ft. each, or to the centre mark. Cut off the hemp cores close up, as shown in Fig. 2, and bring the bunches of strands together so that the opposite strands will interlock regularly with each other. (Fig. 3).

(3) Unlay any strand A, and follow up with one strand of the other end, laying it tightly in the open groove made by unwinding A; make the twist of the strand agree exactly with the twist of the open groove. Proceed with this until all but 24 in. of one are laid in. Cut off A, leaving an end about 24 in. long.

*Abstract from 'Leschens Hercules,' March 1918.

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(4) Unlay strand 4 of the opposite end and follow with strand D, laying it in the open groove as before, and treating this precisely as in the first case (Fig. 2). Do the same with B and 2, stopping 6 ft. short of the first set. Next, with 5 and E, stopping as before, then with C and 3; and lastly with 6 and F. The strands are now all laid in with ends 6 ft. apart, as shown in Fig. 4.

(5) The ends must now be secured without enlarging the diameter of the rope. Take two rope clamps (Fig. 5), and fasten them to the rope, as shown in Fig. 6; twist them in opposite directions, thus opening the lay of rope.

Next, with a knife cut out the hemp core for the necessary distance. Now straighten the ends and drive the marlinespike under the strands (Fig. 6), and work the end into the space previously occupied by the hemp core; then twist the clamps back, closing up the rope. The ends should be laid in, side by side—that is, they should not be crossed over each other. At the point where a tuck is made, hammer with copper mallets to fix the strands firmly in place. Next, shift the clamps and repeat the operation at the other five places, and the splice is made. In splicing rope that is to run over small sheaves or which is to be subjected to excessive strains, wrap the end of each strand for the distance that is to be tucked into the centre of the rope with tarred marline or electrician's tape, which will increase friction and prevent the ends from working out.

If the rope becomes slack, in time, and runs too loose, a piece can be cut out and the rope tightened up. This will require a piece of rope about 60 ft. long and two splices, one splice to put on the piece of rope, the other splice to join the two ends together.

The patent flattened-strand splice is no more difficult and is equally as effective as in the round-strand cable. The method of making this splice is identical up to the point of tucking in the ends of the strands. A slightly different treatment is required in this operation, due to the ratio in the size between the strands and the hemp core. The strand ends (see paragraph preceding directions) should be from 24 to 60 in. long, according to the diameter of the rope. Straighten out the ends of the strands by eliminating as much of the spiral form as possible. The entire length of each strand end is then wrapped with insulating tape, tarred marline or strips of burlap, until its diameter is slightly in excess of that of the hemp core. The tuck is then made similar to that of the round strand splice.

In styles A and C it is necessary to turn the strand sideways at point where it passes to centre of cable, thereby preventing a bulge in the cable. In cases of ropes having five strands, the odd tuck is made at the centre of the splice.

A new oil-well has recently been completed in the Katalla field, Alaska, by the Chilty Oil Co. The initial production is greater than that of any other well in this field. The only commercial production of oil in Alaska is obtained from this field.

CONSTRUCTION OF EMERGENCY BUILDINGS FOR THE WAR DEPARTMENT

Emergency-work to house and to provide for the wants of soldiers in this country and to provide buildings for the manufacture and storage of supplies for the Army, both here and abroad, undertaken by the construction division of the Army, that has been completed, is under way, or is in prospect to June 1, will cost $1,170,619,040. This does not include three projects, costing $106,000,000, that are being constructed under the direct control of the Ordnance Department. All work under the direction of the construction division is performed under an emergency-construction contract, which is based on the cost of the work plus a percentage with an established maximum fee. Under such an agreement no contractor can receive a fee of more than $250,000, no matter how great the total cost of the project may be.

On June 1 the division had completed 53 jobs at a total cost of $202,250,000. It now has 244 projects under way, which when finished will cost approximately $270,369,040. Preparations are being made to start on 117 new projects which are expected to cost $700,000,000. Of the finished jobs, 36 were at cantonments and camps. The total cost for National Army cantonments was $140,726,473. General contractors' fees were $4,000,000, or 2.84% of the total. The National Guard camps cost $38,375,272, on which the Government paid fees amounting to $2,636,534, or 6.98% of the total. On every job the contractors met the expenses of maintaining their organization from the fees collected from the Government, reducing the net profit considerably.

The contract used by the construction division was prepared after all accepted methods for contracting work had been considered. Under its provisions the Government has full control of all work. Its inspectors have the final decision on all matters. The Government retains the right to reject work that is unsatisfactory. The cost of correcting errors must be paid by the contractor from his fee. A check is kept on the payroll. Daily inspections are made to see that all men on the payroll are working. Another check is kept on materials used in the work. The Government pays rent for the use of the contractors' machinery, but if the amount of rental becomes as great as the cost of the machinery it becomes the property of the Government. If the Government wants to keep the machinery, it can do so by paying the difference between the total amount of rental paid and the cost of the machinery. The fees to the contractors range from 7% for contracts of $100,000 or less to as little as 1¾% on large contracts. The fee is set when the contract is awarded. If the cost of the work exceeds the estimate, because of high prices of materials, the contractor receives no additional compensation. Labor and material prices are subject always to the approval of the representatives of the Government.

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Hoisting With Steel Cables

By ERNEST LEVY

Ropes generally break within the lower 150 ft., and nearly always within the lowest 50, especially when the hoisting is done chiefly from the lowest level. This is due mainly to two causes, torsion and vibration.

1. On raising the load the rope twists, and the shorter the loose part becomes the greater is the stress on the rope, owing to the amount of twist having an increasingly shorter length over which to be distributed, hence, when the rope is wound up the torsional stress is greatest.

2. When raising, vibrations are caused to run down the rope; these on reaching the capping become reversed and run up the rope, and in places synchronize with those coming down; at these points of synchronization the strain is most severe. These points are situated within the lowest 150 ft., because at this distance the upward-going vibrations have diminished and died. Hence, the lower 150 ft. has become weakened; in cases, therefore, where the bulk of the hoisting is done from the lowest level it is not advisable to change the rope, end for end, as such procedure would bring the weakened part of the rope into that position which requires the greatest strength.

The best method for prolonging the life of the rope is to cut from the lower end a length two or three feet in excess of the length of the arc of contact of the rope on the sheave-wheel when the cage hangs freely. This brings the two upper positions of weakness to new places where the strains on them will not be so great, and at the same time the better preserved parts take their places. Rapid hoisting, such as is usual in large coal mines and in the Rand mines, necessitates cutting off the cable every four or six months. One wire broken here and there is not a serious matter, but when several are broken in the same neighborhood the rope is dangerous.

The following directions to the master-mechanic are useful:

1. A weekly examination should be made of all ropes, cages, brakes, clutches, and sheaves, connected with hoisting appliances for raising or lowering men, and a test of the cage-dogs made.

2. The draw-bolt and pin attaching the cage to the rope should be annealed at least once every six months. When the cages are changed it is advisable to have the draw-bolt annealed.

3. Ropes should be greased at least once every month.

4. Ropes should be re-clamped at least once every six months, a minimum of six feet of the rope being cut off each time. The portion cut off must be carefully examined, both as to the exterior and the interior, for corrosion and breaks.

5. Ropes should be discarded either when the number of broken wires in one 'lay' exceeds six, or when the wires on the crown of the strands are worn to less than 65% of their original diameter, or when they show marked signs of corrosion, provided, however, that when such broken wires are reduced by wear more than 30% in cross-section, the number of breaks in any lay of the rope shall not exceed three. In any case, ropes should not be used for more than three years unless a piece cut from the clamping end has been tested by actual breaking-test under supervision of a competent authority.

6. Ropes should be securely fastened to the drums and, when in use, should never be fully unwound; at least one full turn must always remain on the drum.

The 72 outside wires of the rope come to the surface once in every complete turn in the rope's construction, or in every 'lay,' as it is technically termed. With respect to external wear, the places in the rope that should be specially watched are those where the contact with the sheaves or guide-pulley occurs at acceleration or retardation periods of the hoist. These places are also likely to suffer more than others from internal wear, except perhaps that portion of the rope near the cage, which, although generally subjected to no wear from rubbing, yet is exposed to a corrosive effect as well as to the bending and shock stresses. In addition to these positions, attention must be directed also to that part of the rope which lies between the drum and the sheave when the load is at the bottom of the shaft, as also to those parts of the rope which come in contact with the flanges of the drum.

Records of results of all the above directions should be kept either on regular forms or in a book provided for the purpose.

Hoist-men should be warned that:

1. Any defects should be reported immediately to the superintendent, master-mechanic, or other person in charge of the works at the time.

2. Every morning, before hoisting or lowering men, each cage must be run a complete trip up and down the shaft, with a view to making sure that everything is in good working condition.

3. The night-shift man should be required to make an examination daily of all parts of the hoist and to pay particular attention to the controller, brakes, clutches, and ropes. The results of such examination should be recorded on the form provided therefor, and placed on file at the mine office.

4. After every re-clamping of the rope, every rope so treated should be run for at least four trips under full load, before being used for lowering or hoisting men.

5. When a new hoisting-rope is put into use, it should be run for at least 10 trips under full load before being used for lowering or hoisting men.

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Expansion of Metals by Heat

By JOHN ROGER

The expansion of metals by heat is usually given as the percentage of elongation that takes place when samples of the different metals of equal lengths are raised in temperature an equal number of degrees, for instance, from 500 to 501°F., thus establishing a co-efficient of linear expansion. When the expansion is given volumetrically, that is, by equal volumes of the dissimilar metals, the relations of the co-efficients are considered to be the same, that is, the metal is supposed to expand equally in all directions, the volumetric expansion being the linear expansion multiplied by three. The irregularity of these co-efficients for different metals has led to much discussion as to the cause when the great irregularity observed is not due to the peculiar behavior of the metals but to the way in which the co-efficients have been determined. The figures given by different experimenters lack uniformity, so that only approximate relationships can be shown, but they are near enough for present purposes.

It must be evident that if the temperature of one cubic foot of nickel is raised 1° F. with a specific heat of 59.97, and the temperature of 1 cu. ft. of lead is raised 1° F. with a specific heat of 21.97, and the relative expansions are compared, the comparison does not involve two things that are equal or proportionate. Almost three times as much energy has been added to the nickel as to the lead, and it should be clear that co-efficients determined in this way must lead to confusion. To get the proper relationship in the expansion equal units of energy must be added to each. If the co-efficient of expansion, as determined by equal units of temperature, is divided by the volumetric specific heat we will get co-efficients by equal units of energy, and these will be found to be, in a general way, inversely proportionate to the force of atomic attraction, as indicated by the number of degrees between normal (the temperature at which the specific heat was taken, say 500° absolute) and the fusion temperature for each metal. The co-efficients of expansion would seem to increase as the metal gets softer, but the figures are not regular enough to admit of saying that this is actually so.

In the accompanying table the figures have been taken from the best sources of information available, but they are no doubt far from being correct. The column 'Co-efficients of expansion by equal units of temperature' is supposed to be the co-efficients per cubic foot of metal, in each case raised in temperature from 500° to 501°, that is, raised 1°, which for nickel would give $59.97 \times 778 = 46{,}356$ ft.-lb., while for lead it would represent $21.97 \times 778 = 17{,}062$ ft.-lb. of energy, and for the other metals an amount proportionate to their specific heats. The column 'Co-efficients of expansion by equal units of energy,' gives the co-efficients by temperature divided by the specific heat in each case, which gives the expansion of one cubic foot of each of the metals, due to the absorption of 778 ft.-lb. of energy, and these co-efficients, as will be seen, are in a general way, inversely as the force of cohesion, as indicated by the melting temperatures, or just what might naturally be expected.

The confusion as to the expansion of metals by heat may be said to come from three things: first, from estimating the specific heat of metals by gravimetric proportion; second, from failure to differentiate between heat and temperature; and, third, from the contemplation of latent heat, something which does not really exist.

Seemingly empty gasoline cans or tanks are probably more dangerous than those filled with gasoline. Usually the can is not entirely emptied, the remaining gasoline will vaporize, the vapor will mix with the air in the can, and the mixture may easily be explosive. When the can is being filled, this mixture is forced out by the gasoline and may explode if ignited by a flame or spark near the opening.

Oil in shale is considered by some engineers not indigenous to the shale from which it can be distilled, but was formed elsewhere and then migrated to the shale, where it became adsorbed and inspissated, so that it cannot be extracted by solvents of petroleum, but must be obtained by destructive distillation. This distillation is a complicated process.

Co-efficients of Expansion of Metals

Metal	Specific heat per lb.	Weight per cu. ft. lb.	Specific heat per cu. ft.	Co-efficients of expansion by equal units of temperature	Co-efficients of expansion by equal units of energy	Tensile strength per sq. in., lb.	Temperature to melt above 500 deg.	Melting temperature absolute, deg.
Platinum	0.032	1,347	43.10	0.0000144	0.000000334	50,000	3160	3660
Nickel	0.109	548	59.97	0.0000208	0.000000347	80,000	3060	3560
Iron	0.113	480	55.58	0.0000197	0.000000354	60,000	2760	3260
Copper	0.095	552	52.44	0.0000266	0.000000507	34,000	1890	2390
Gold	0.032	1,200	38.40	0.0000236	0.000000613	20,000	1932	2432
Silver	0.057	655	37.33	0.0000324	0.000000867	36,000	1710	2210
Aluminum	0.214	167	35.10	0.0000369	0.000001051	20,000	1175	1675
Zinc	0.095	436	41.42	0.0000422	0.000001018	6,000	740	1240
Tin	0.056	458	25.64	0.0000349	0.000001357	5,000	402	902
Lead	0.031	709	21.97	0.0000471	0.000002143	3,000	585	1085
Antimony	0.051	421	21.42	0.0000388	0.000001811	1,000	770	1270

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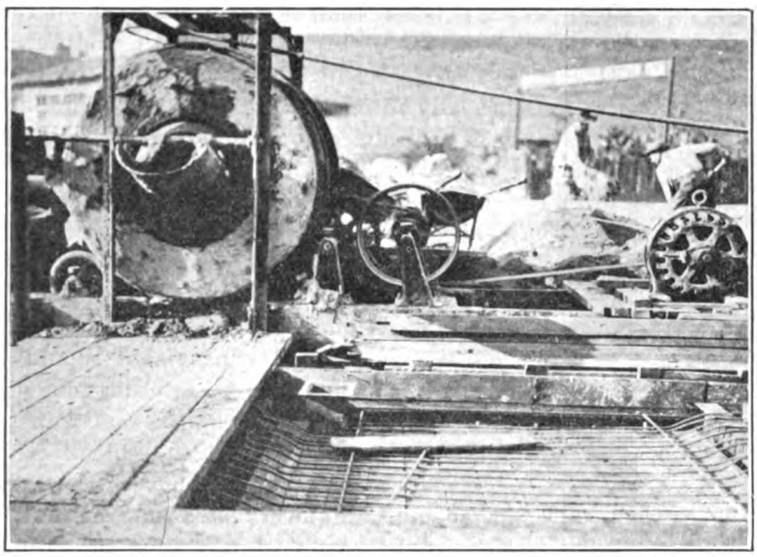
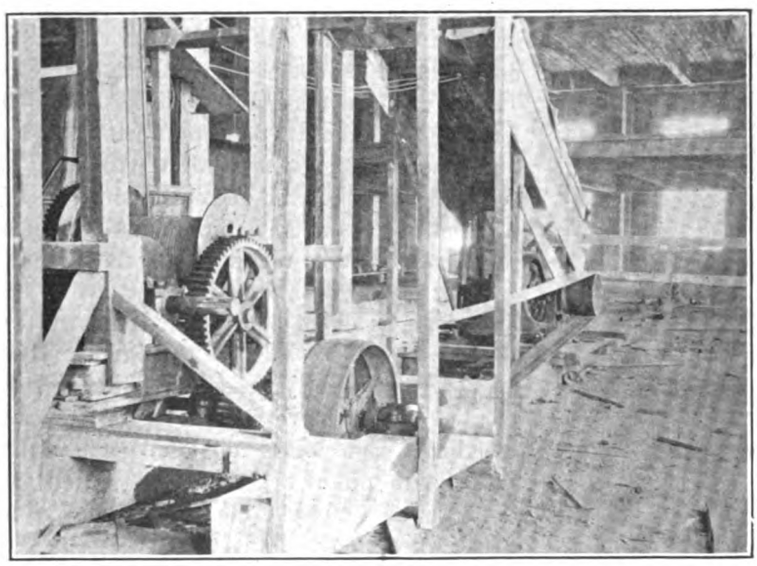
Machinery Hazards on Construction Work*

By J. J. ROSEDALE†

The safeguarding of contractors' equipment is a matter that needs constant attention, as this equipment is frequently moved from one job to another. The machinery found on construction work consists mainly of concrete-mixers, engines, hoists, steam-crushers, saws, and pumps. The General and Woodworking Safety Orders issued by the Industrial Accident Commission effective January 1 and August 1, 1916, respectively, require that machinery in all places of employment—indoors, outdoors, or underground—must be safeguarded. Although these Orders have been in effect for two years, I have frequently found, on tours of inspection, dangerously exposed machinery, which in some cases has been the cause of accidents.



EXPOSED BELT, PULLEY, AND MOTOR ON CONCRETE-MIXER



EXPOSED GEARS, BELT, AND PROJECTING SET-SCREW ON HOIST

The following table has been completed, covering all classes of construction work. This table is not arranged according to industries, but includes all classes of injuries.

Injuries sustained on construction work due to unguarded machinery in California*

Fatal:		Permanent and serious:	
1914	5	1914	62
1915	6	1915	53
1916	6	1916	80
Total	17	Total	195

*Compiled from accidents reported to the Industrial Accident Commission.

From the average amount paid for compensation and medical fees per accident, it is computed that the 17 fatal accidents for the three years cost $40,000, and the 195 permanent and serious injuries, $214,500.

Considerable difficulty has been found in inducing contractors to safeguard their machinery. There are several reasons for this: first, that most machinery used on construction work is rented by the contractor and is delivered and connected by the owner of the equipment; the contractor when informed by an inspector to safeguard such machinery usually refuses, for the reason that he does not own it. Second, both the owner of the equipment and the contractor argue that it does not pay to safeguard equipment because the job will last only a short time. Third, the speed and high pressure under which most construction work is performed causes the contractor to evade the law, and avoid anything that he thinks will retard the progress of the work. Fourth, the workmen themselves often discard safeguards from circular saws and other machines. Statistics show that over 1,000,000 employees have been injured in the last ten years in the United States on power-saws. There is no excuse for operating power-saws without the safety-devices specified in the Woodworking Safety Orders issued by the Industrial Accident Commission. These Orders require that a circular say be provided with a hooded guard and with either a splitter or spreader or with dogs in the rear of the saw, except where special work is being done. Most of the work on circular saws on construction jobs con-

*From 'California Safety News.'

†Construction engineer, Industrial Accident Commission of California, 525 Market street, San Francisco.

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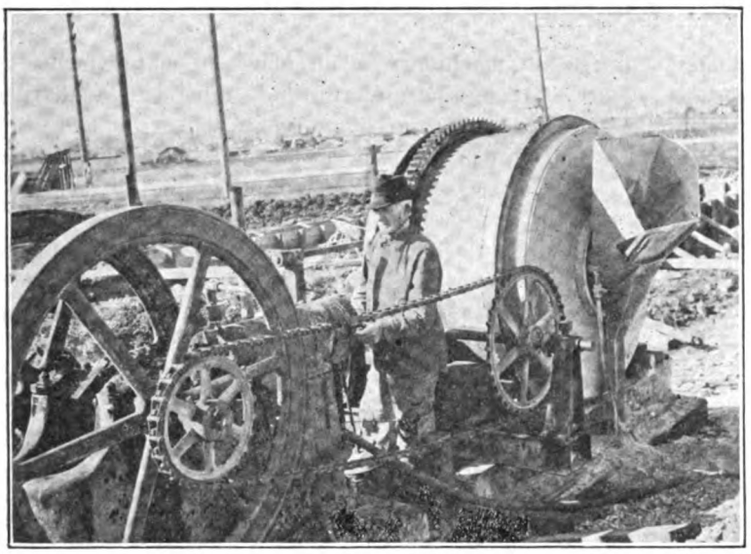
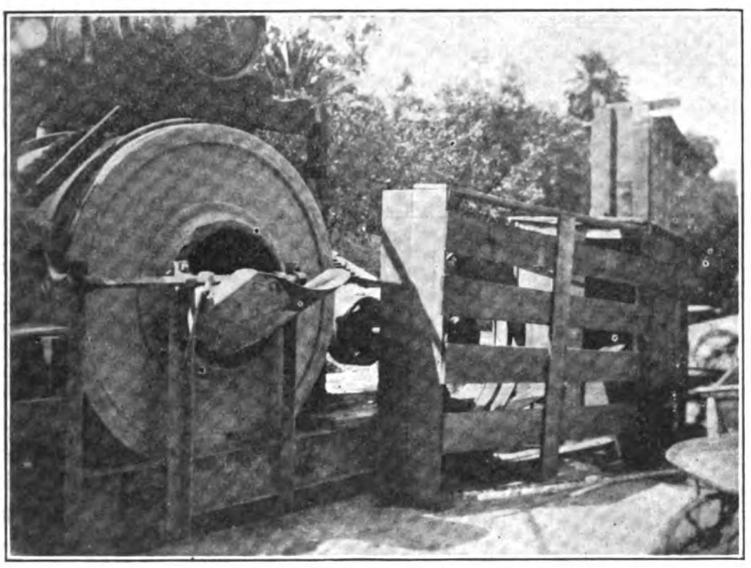
sists of straight ripping, and a saw-guard need never be removed. I investigated a fatal accident about two years ago, where a bricklayer foreman had removed the saw from the table and installed a 14-in. emery wheel in its place, for grinding bricks. This emery wheel was run



EXPOSED FLY-WHEEL, SPROCKET-CHAIN, AND PROJECTING SET-SCREWS ON BOTH SPROCKET-WHEELS



HOME-MADE GUARD ON GASOLINE-ENGINE RUNNING CONCRETE-MIXER

at double its safe speed, which caused it to burst and kill the operator.

Practically all of the machinery used on construction work can be guarded with home-made guards. There is nearly always enough surplus lumber and nails lying around construction work to safeguard fly-wheels, belts, pulleys, gears and sprocket-chains. Too much attention cannot be given to guarding machinery, and the contractor should never allow his employees to use a machine until it is properly safeguarded.

BLOCK PAVEMENTS AND RAIL FILLERS FOR CAR-TRACK AREAS

By JOHN S. CRANDELL

*The most frequent cause of poor paving in street-railway track-areas, aside from loose rails and broken joints, is the failure of the rail-plaster or filler. Many traction-lines fill the space along the web of the rail with cement grout. This too often has insufficient time to set before traffic is turned on the tracks, with the result that it rapidly crumbles and is not better than so much sand. Other rail-fillers have been tried with indifferent success; creosoted planks, bituminous fibre, specially formed brick and other fillers have been abandoned in favor of grout, and the grout itself has failed sometimes.

Many cities require the same kind of pavement in the track-area that is laid on the rest of the street. This is wrong. Sheet pavements have never given good results in this situation. A block pavement of some kind is necessary, because the pavement should be one that may be taken up in order to repair broken joints and bonds and re-laid with the minimum of trouble. Granite-block pavement with a bituminous filler is the cheapest in the end. Engineers have thought that by grouting granite-block pavement they would offset any defects in the rail-plaster. This is not always true. If the rail-filler fails the pavement also fails. Wood-block pavements have given trouble to street-car companies only when the blocks were laid incorrectly. To get the best results, the blocks should be laid on a smooth concrete base that has previously been given a thin paint-coat of coal-tar pitch. On no account should a sand cushion be used. The joints should then be filled with pitch and the surface given a coating of sharp sand. Bleeding, while disagreeable, is not a bad sign. It shows that there is creosote present in the blocks. However, with properly seasoned and carefully treated blocks there should be scarcely any bleeding. The joints must be made waterproof with pitch, otherwise the water that finds its way under the blocks will cause trouble. Brick pavements laid with a pitch-sand mastic, consisting of equal parts of pitch and sand, are satisfactory and are more quiet than when the joints are filled with cement grout.

Danger signals should be put in dangerous places, and left there as long as the danger exists, but should be removed as soon as the danger is removed.

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*Abstract from 'The American City.'

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Properties of Twist-Drills

Bulletin No. 103 of the Engineering Experiment Station of the University of Illinois by Bruce W. Benedict and W. Penn Lukens contains the results of an investigation of twist-drills. The following conclusions are given:

1. With the usual angles of grinding, the power used at the drill-point decreases as the helix-angle increases until the helix-angle reaches 35°, above which there is no further decrease in power. Above 40° the power begins to increase. A helix-angle of 30 to 35° seems also to give the best average endurance in cast-iron.

2. For corresponding speeds and rates of feed the variation in torque for point-angles between 108 and 138° is slight, but the torque increases for point-angles below 108°. The variation in thrust for point-angles between 98 and 118° is slight, but the thrust increases rapidly as the point-angle increases above 118°. Drills with point-angles greater than 118° show less endurance than drills with point-angles smaller than 118°, while drills with point-angles less than 118° show less susceptibly to burning at the corners, but a greater liability to chipping of the cutting-edge and a general weakness of the drill because of the removal of metal backing the chisel-point. In general, a point-angle of 110° is better than an angle of 118°.

3. Variations in the clearance-angle at the drill-periphery and variations in the clearance at the drill-centre (as indicated by the value of the edge-angle) seem to affect the net power slightly. Unless the peripheral clearance is less than two degrees, variations in its value have little effect on the torque or thrust, but if the edge-angle is less than 120°, the thrust tends to increase, showing a more rapid rate of increase for the heavier rates of feed. A peripheral clearance of 6 or 7° gives the most satisfactory drill-endurance. An edge-angle of 130° is recommended for all but the heaviest feeds (above 0.041 in. per revolution). This angle should not vary with variations in peripheral clearance, but may be varied with the feed per revolution, decreasing for light feeds and increasing for heavy feeds.

4. The power required at the drill-point and the drill-endurance seem to be affected by the form of the chip-space and the form of the cutting-lip. Drills having the greatest chip-spaces and concave cutting-edges give good results under all conditions of work and point-grinding. Attempts to increase chip-space near the hilt of the drill by decreasing the helix-angle are apparently of small value, and the decreased helix-angle when the drill is ground causes increases in the power required and lessened endurance.

5. In soft cast-iron the torque does not increase so rapidly as the feed per revolution, although the variation of torque with feed is so nearly direct that it may for all practical purposes be so considered. For the correct angles of drill grinding the thrust should increase directly with the feed per revolution.

6. In soft cast-iron the torque decreases as the speed increases, although there is little advantage in running a one-inch drill faster than 350 r.p.m. The saving in power resulting from increasing speed may amount to 10 or 15%. Thrust decreases as speed increases for corresponding rates of feed, although the advantages to be gained by running a one-inch drill faster than 400 r.p.m. are slight.

7. Drilling a pilot-hole the diameter of which is equal to the width of the chisel-edge reduces the thrust of the large hole by 60 to 70%, the reduction being greatest for the heavier feeds. The torque of the larger drill varies according to the area of metal removed by the pilot-drill.

8. The power loss in the back-gears of a drill-press increases directly as the feed per revolution and may be from 5 to 8% of the total power consumed. The efficiency of the drilling apparatus increases with the rate of drilling, and for these tests varied between 8 and 60%. The net power for a given rate of drilling varies with the feed used, being greater for the light feeds and less for the heavy feeds, although there is little advantage in using a feed greater than 0.041 in. per revolution. The gross power is a function of several variables, including the variation in net power, the power consumption of the drill when running idle, the increase in torque and thrust for the heavier feeds, and the means of gearing for different speeds. For efficiency of drilling with this apparatus in cast-iron, the feed should not be less than 0.013 in. per revolution, and should increase with the rate of drilling to 0.041 in. per revolution for a rate of nine inches per minute. So far as power consumption is concerned, whether net or gross, the best way to remove metal with a given drill is with as high a speed and as heavy a feed as the drill will stand.

9. By first drilling a pilot-hole with a diameter equal to the thickness of the drill-web, the gross power when drilling the larger hole may be reduced 10 to 12%. A blunt drill increases the gross power by reason of the greater thrust which causes greater losses in the drill-press. A drill with a point-angle greater than 118° or a drill with an edge-angle less than 130° will increase the gross power for the same reason.

10. The endurance of a drill may be increased 300 to 1000% by the simple process of rounding the sharp corners at the drill-periphery.

11. For drilling holes at depths of more than three inches, a drill with a large helix-angle gives best results. Such holes should be drilled at as high a speed as possible, for then the screwing action of the drill-flutes removes a larger proportion of the chips.

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Federal Employment Bureau for Unskilled Labor in War Industries

After August 1 no employer with war-business who has a force of more than 100 workers will be permitted to recruit common labor. All such employers will be required to use the Federal Employment Service. While the restriction against private recruiting applies for the present only to unskilled labor, as soon as possible it may be extended to include skilled labor. Eventually no employer may be permitted to employ men unless the latter have United States Employment Service cards. In the meantime, however, private recruiting of skilled workers will be subject to regulations prescribed by the service, which will prevent the wholesale labor 'stealing' and 'poaching' that has been largely responsible for the disorganization of the labor supply.

This order is a result of the unanimous decision of the members of the War Labor Policies Board of the Department of Labor that the first step toward labor-stabilization must be the centralization of all labor-recruiting activities in the Employment Service. This board consists of the heads of the various arms of the Department of Labor and the production chiefs of the War, Navy, and Agriculture Departments, the Shipping and War Industries Boards, and the Food, Fuel, and Railroad Administrations. Its chairman is Felix Frankfurter, assistant to the Secretary of Labor.

The overcoming of present shortages and the insurance to war manufacturers of an adequate supply of labor for the future has made this step imperative. The war industries of the country are perilously short of men. The situation with regard to common labor is especially critical. Inadequate as the immediate supply of unskilled labor is, from 25 to 40% of it has been rendered potentially idle because it has been rushed from place to place by the recruiting agents. The reserves of skilled workers are depleted and the non-essential industries must be combed for men for the war industries.

Centralization of labor recruiting in the hands of the Government employment system is not intended as repressive. The prohibition against private recruiting activities is designed to ensure the full manning of the essential industries for the future, as well as to overcome existing shortages. One of its most potent benefits will be the reduction of the large labor-turnover that has been caused by unregulated private competition.

This is the first step in the war-labor program for labor stabilization. Standardization of wages, without which the Employment Service will be placed under a handicap, is now under consideration by the War Labor Policies Board, which also will discuss hours of labor and working conditions. The absorption by the United States Employment Service of the supplying of all war-labor will be gradual. For six months, since its reorganization, last January, the Service has been organizing a national recruiting and placing system. It has united all Federal and State employment systems, opened scores of new employment offices at strategic points, and built up a great recruiting agency that covers virtually every county and township. More than 400 offices are already in operation and new ones are being opened daily. The recruiting machinery, which is the Public Service Reserve, has 17,000 agents throughout the country, and this number is to be increased to 25,000.

The Employment Service has its main office at Washington. The States are grouped, according to homogeneity of industrial interests and problems, into 13 employment districts, each district in charge of a superintendent. Generally the States, each of which has a State director of the United States Employment Service, handle interstate labor clearances or transfers, while clearances between the States are supervised by the district superintendents. Clearances between districts as well as general supervision of the field work are in charge of the main office at Washington.

The new labor-supplying program of the Employment Service will be conducted in accordance with the following four cardinal principles:

1. War work must have men at any cost.
2. Withdrawals of workers from non-essential industries for war industries will be equalized.
3. The volunteer principle will be followed in dealing with the individual worker.
4. Fit men only will be sent to war industries.

While emphasizing that the situation is such that there can be no temporizing and that labor must be found for war industries at all costs, the Department of Labor and its War Labor Policies Board place equal emphasis upon the need of assistance from individual employers and employees and their organizations. Their advice and co-operation is deemed essential to the success of the labor mobilizing and stabilizing program. As one means of obtaining this co-operation, community boards, with equal representation of employers and wage-earners, will be formed in all industrial centres to work with the representatives of the Employment Service and its Public Service Reserve. Since labor priorities are best determined locally, these community boards will be asked to play an important part in determining how withdrawals of workers for essential production will be made. Employment managers especially will be urged to work with the local offices of the Employment Service and the agents of the Reserve.

Manufacturers of non-essentials, farmers, war manufacturers with less than 100 workers, and the trans-

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portation industry are for the time being not included in the prohibition against private recruiting, although their activities will be regulated by the Employment Service, whose rules will be announced shortly. A number of the railroads, however, have already agreed to get their labor exclusively through the Service and their agencies have been placed under the direction of the Federal Service.

All war industries will give to the Employment Service estimates of their coming needs. With these reports as a basis, each State will be given a quota of common labor, which may be drawn as men are needed. The State quotas will be determined by the main office at the Employment Service, and will be based upon each State's resources as accurately as possible. The State directors of the Public Service Reserve in turn will divide their States, assigning to each division a certain portion of the State's quota. Each State director, in re-distributing his State's quota, will consult with the Reserve directors of other States, the directors of the Employment Service proper, and with business men. The quotas are not drafts upon the States, but, as a matter of fact, constitute a protection to the States. Some States have been drawn upon too heavily, while others have not given their fair share. By a system of State quotas the fairest possible figures will be determined. Industries within a State will be served, wherever possible, by withdrawals from non-essential industries within its borders.

With the Public Service Reserve machinery in each State attending to the recruiting, through agents in virtually every community, the local offices of the Employment Service will attend to the placing. All calls for common labor will be carefully checked by the branch employment offices in order that only actual needs may be given attention. It has been found that many firms still call for 1000 men in a week, when actually 200 cannot be used within three weeks. The best men in industry for the war industries will be the goal of the Employment Service. When expedient, local health boards will be utilized in determining the physical fitness of workers.

Pitiless publicity will be the recourse against any employer who fails to comply with the labor-recruiting regulations. Violations will be investigated and the facts made public. Through its control over raw materials, the War Industries Board, represented in the War Labor Policies Board of the Department of Labor, will have a lever against any recalcitrant employer that may selfishly persist in disregarding the rules laid down for the stimulation of America's war production.

War manufacturers will be protected against inroads upon their working-forces by private 'labor-scouts' by this centralizing program. No longer can any shipyard or war-materials manufactory take men from another equally essential enterprise. Farmers will be one of the classes of essential producers to benefit. In many regions, notably in the South and East, farms have been swept bare of labor by private recruiting agents. Hereafter agents will be prevented from going on farms and taking away harvest-labor at the time when it is most needed.

To what extent labor is to be found for plants with both war and non-essential business will be determined by the Employment Service authorities in the localities in which such industries are operating. In helping all such industries, however, the Service will first see whether a lack of men in the war-end of the plant cannot be met by transferring workers from the non-essential end.

The Western States are in districts No. 12 and 13. Following are the offices that have so far been established:

District No. 12

Arizona: Flagstaff, Phoenix, Tucson, Yuma.

Utah: Ogden.

Nevada: Gardnerville, Reno.

California: Alturas, Anderson, Antioch, Bakersfield, Berkeley, Bieber, Cedarville, Chico, Colusa, El Centro, Eureka, Fresno, Grass Valley, Hanford, Hayward, Hemet, Hollister, Hynes, Indio, King City, Los Angeles, Loyalton, Madera, Marysville, Merced, Modesto, Napa, Newcastle, Oakland, Oxnard, Placerville, Porterville, Red Bluff, Redding, Sacramento, Salinas, San Bernardino, San Diego, San Francisco, San Jose, San Luis Obispo, Santa Ana, Santa Barbara, Santa Maria, Santa Rosa, Sebastopol, Stockton, Susanville, Tehama, Vacaville, Visalia, Watsonville, Willows, Winters.

District No. 13

Idaho: Boise, Pocatello, St. Anthony, Twin Falls.

Oregon: Medford, Portland.

Washington: Aberdeen, Bellingham, Everett, North Yakima, Seattle, Spokane, Tacoma, Walla Walla, Wenatchee.

In making electric-arc welds the positive terminal should be fastened to the metal to be welded; the negative terminal to the carbon electrode. The arc should be as long as possible. The weld should be made with the fewest possible applications of the arc. The arc should be given a rotary motion and should have as large an area as possible instead of being concentrated on one spot. The metal to be welded should be free from dirt and slag before commencing to weld. Vigorous hammering should accompany the making of a weld.—National Engineer.

Cost of maintenance of 80 miles of concrete-paved highway in Kern county, California, for the year ended May 31, 1918, was $6616.47. The highest cost per mile was $253.88 and the lowest $12.65. The pavement was from 4 to 5 in. thick with an oil-and-screening wearing-surface. The roads have been in service from one to three years. Most of the repair work has been caused by the use of poor aggregate during construction.

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Country Grain-Elevators*

By JOHN W. CUNNINGHAM†

The term 'country elevators' includes those structures that receive grain from the farmer and subsequently deliver it to cars for shipment to the market-point. There are also transfer-elevators, terminal-elevators, and flour-mill elevators; a diversity of buildings with machinery for elevating and handling grain; each serving a particular purpose.

Elevators may be constructed from almost any of the ordinary building materials. Steel elevators are common, also hollow-tile elevators. For the north-western States, Oregon and Washington, the materials that will ordinarily be considered are wood and concrete. Concrete is the best material for country elevators. Likewise there will be few localities in the North-West where wooden construction is not cheaper. Criticisms of concrete grain-bins for not being waterproof and causing grain to heat and mold are based upon isolated cases of inferior workmanship. Most of the large terminal elevators built in recent years are of concrete. On the other hand, wooden grain-elevators are tight and dry, and if painted at intervals and maintained, will last for some time. Concrete elevators in themselves will not burn and they furnish excellent protection to their contents against fires from the outside. Timber elevators are inflammable, but may be protected by metal sheathing on the outside and by heavy mill-construction, fire-proofing paints, and automatic sprinkling-devices on the inside. The choice of wood or concrete construction will depend upon local conditions. Local prices of materials, availability, time of delivery, and fire-risk should be considered.

The wheat-growing districts of the north-western States require a different type of elevator from that which has been developed for the Middle West or even Canada. In the first place the greater distances to railroad and the larger farms require the construction of larger units. It is probable that few elevators will be built with less than 40,000 bushel capacity, ranging from this size to 100,000 bushels. A second element controlling the design of elevators for the North-West is the greater number of varieties and grades of grain grown in any one locality. Where smut is prevalent, additional bins must be included for infected grain, and it may even be advisable to go so far as to provide separate hoppers and legs for the smutty grain. For an average community elevator 16 bins will be the minimum for successful operation, and 20 or more bins will facilitate working, storing, and shipment. For convenience these bins should be of different capacities, ranging from the large storage-units for the more common grades down to shipping-bins holding one or two carloads.

For wooden elevators there is no type of studded or braced construction practical and satisfactory as rectangular crib-work bins. Studded construction is more economical of lumber, but it requires rods throughout, which at the present time are not only costly, but hard to get. Crib elevators are built from stock sizes 2 by 4 in. to 2 by 8 in. and are readily and rapidly constructed by workmen of average skill. The most economical form in which concrete can be used is the circular reinforced bin. Smaller bins for working purposes may be either circular or rectangular in form, or may be formed by the interstices between the circular bins. Probably the most satisfactory plan is two outer rows of large circular bins for the storage after cleaning of the most common varieties and grades of wheat, and between these a group of smaller elevated bins for the less popular varieties and for working-storage.

For the average country elevator, ground-space is not of exceptional value, and nothing is gained by building a tall structure. While it is possible to arrange almost all machinery and devices for remote operation, it is better to have close at hand those machines that require frequent attention. Where an elevator is to be operated by one man, who is probably not an all-round mechanic and repair man, a simple arrangement is better than one that tries to accomplish too much by machinery.

The first essential for a good elevator is the foundation. In general this should be of concrete. The foundation should be proportioned to carry safely the weight of the structure and its contents. On yielding soil, spread footings or even piling may be required. Elevator-pits and basements must be kept dry. On the basement-floor of the elevator must be placed the conveyor and spouts for taking grain out of the bins, together with the dump-sink and boots. The operator should be able to go to any part of the basement for fixing gates and oiling and adjusting machinery without bumping his head or going on his hands and knees. Also there should be no out-of-the-way corners in which the near-sighted operator may allow dirt to pile up and grain to mildew and sprout.

The driveway, dump, and office are commonly built at one side, or rather end of the elevator. The tendency is usually to get the driveway too high and to reduce the size and slope of the dump-sink. This may reduce the excavation and cheapen the construction, but money spent for a freely discharging sink and a driveway on an easy grade is well invested. Bins should have hopper-bottoms with a liberal slope so that the last kernel will run out when the gate is opened.

*Abstract from 'Journal' of the Oregon Society of Engineers.

†Consulting engineer, Portland, Oregon.

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In the elevator-cupola the same general ideas will apply as in the basement. Nooks and crannies should be eliminated. A man should be able to stand erect and walk or work where work is to be done. The less machinery in the cupola, the better. Elevator-heads are a necessity, but conveyors in the cupola should be replaced where possible by spouting. To give access to the cupola there should be a man-lift, and since man-lifts are known to stick and fail to operate, there should also be an accessible and well-built ladder.

Grain may be handled from the farm to the elevator in sacks or in box-wagons. If in sacks, these are emptied through a grating into the receiving-hopper. Where wagon-boxes are used for hauling, the load is weighed on platform-scales in the elevator-shed; then the end-gate is opened, the traces loosened, and the wagon tilted on a platform supported on the scale itself, spilling the grain through a trap into the receiving-sink.

From the sink under the dump-scales the grain is elevated for the first time. The elevator consists of a belt carrying metal scoops or cups driven by a pulley at the top and running under an idle pulley at the bottom. From the elevator, grain is spouted either to a bin or to the cleaner. A grain-cleaner is nothing more than an improved fanning-mill. It shakes, sifts, and blows out the loose dust, chaff, sticks, strings, and smut balls, but does not remove smut or other matter sticking to the kernels of grain. The dust and dirt are blown outside or into a collector, while the chaff and the heavier particles, containing some shriveled and broken grain, is otherwise disposed and may be sold for feed. From the cleaner, the grain will usually again be elevated. If a hopper or automatic scale is provided it may again be weighed before being spouted into a storage-bin where it is held until time for shipment.

After a sufficient amount of one grade of grain has accumulated in the elevator, shipment is begun. Box cars, lined with tight inside-doors, are set out opposite the elevator. If the grain to be shipped is stored in bins close to the track, it may be spouted directly into the cars; otherwise it is drawn from the bottom of the larger bins, elevated to the top of the building, and discharged into the cars. For loading a flexible metal spout-end permits the grain, spouted with considerable velocity, to be thrown nearly to the ends of the car.

A common mistake in the choice of machinery is lack of balance. A 2000-bushel-an-hour cleaner is no advantage if it must be fed by a 1000-bushel leg. Another mistake is to place machines in cramped positions so they cannot be readily cleaned, oiled, and maintained.

Elevator boots and heads should be of good design for complete filling of the cups and for free and rapid discharge. Spouts should have a steep slope, and bends and angles should be eliminated as far as possible. Shafting, pulleys, and gears should be housed or protected for safety's sake.

Not the least important part of an elevator's equipment is the motive power. Where electric power is available it should be used. Otherwise an oil or a distillate engine will be needed. With a concrete elevator the engine may be placed in the building itself, convenient to the office and working-floor. With a wooden elevator the fire-risk will make it advisable to house the engine separately with a shaft or belt-drive to the elevator.

Insurance rates are often neglected in elevator-design. A fixed system of rating for standard modes of elevator construction has not yet been adopted for Oregon, although such a code is now in course of preparation. To give a general idea of how rates are made and what factors are to be avoided in elevator construction, the following table, used in the Middle West, and giving rate per $100 insurance carried, is given below. Similar rates will probably be adopted on the Pacific Coast.

Basis rate for crib-elevator, metal sheathing, fire-resistive roof, and detached or fire-resistive power-house	$1.75
For shingle roof—add	0.50
For wooden sheathing—add	0.10
For frame power-house attached to elevator—add	0.50
For gasoline-engine in elevator—add	0.75
For man-lift to cupola—credit	0.10
For lightning-rod equipment—credit	0.10
For standpipe and hose—credit	0.10
Basis rate for elevator building of bins entirely of reinforced concrete with metal elevator-legs and spouts	0.25
For wooden elevator-legs—add	0.25
For wooden spouts—add	0.25

A study of these rates will show that an elevator constructed without regard for fire-risk will burden its owner with a large annual tax, while alterations in plan adding little to original cost will soon pay for themselves. The advantage of the concrete elevator is striking. It is common to omit insurance on a concrete elevator-building, insuring the contents only.

Utilization of garbage is being advocated by the United States Food Administration, which is advising all State administrators to spread garbage-utilization propaganda through their territory and urge upon housekeepers the necessity for keeping garbage (kitchen and table refuse) in a separate container from other house refuse. Statistics issued by the Food Administration show that in one ton of garbage there is sufficient glycerin to make the explosive charge for fourteen 75-millimetre shells, enough 'fatty acid' to manufacture 75 lb. of soap, fertilizer elements to grow 8 bu. of wheat, and a score of other valuable materials essential in the manufacture of munitions. At least 24 cities of over 100,000 are not utilizing garbage. The combined population, which is estimated to be over 5,000,000, is wasting 4,400,000 lb. of nitro-glycerin and 40,000,000 twelve-ounce cakes of soap, besides 60,000 tons of tankage containing fertilizer elements sufficient to produce a 3,000,000-bu. wheat crop. The value of these lost materials is estimated at $5,000,000. In 29 cities where there are garbage-utilization plants a combined population of 18,000,000 people are utilizing these products, to the value of over $11,000,000 annually, and a large proportion of this saving is being used directly by the Government in munition-making. Plans are under way in several cities for the manufacture of alcohol on a large scale from garbage. In other cities the garbage is fed to hogs. The hog-raising operations are sometimes under private and sometimes under municipal control.

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Priority Orders for Iron and Steel*

1. Pig-iron and steel manufactured products are now being shipped and delivered by the producer or manufacturer in accordance with the resolution of the War Industries Board adopted June 6, 1918, after conferences with representatives of the American Iron and Steel Institute, as follows:

Whereas, a careful study of the sources of supply in connection with the present and rapidly increasing direct and indirect war requirements for iron and steel products has convinced the War Industries Board of the necessity for (1) a strict conservation of the available supply of iron and steel products on the one hand, and (2) the expansion of existing sources and development of new sources of supply of iron and steel products, on the other; and

Whereas, the producers of iron and of iron and steel products in the main concur in this conclusion reached by the said board and have expressed their willingness to co-operate whole-heartedly with the said board in its efforts to provide for meeting promptly the direct and indirect war requirements of the United States and its Allies for iron and steel products:

Now, therefore, it is understood and agreed by the committee on steel and steel products of the American Iron and Steel Institute and the War Industries Board that no pig-iron or steel manufactured products shall be shipped or delivered except as follows:

(1) By priority certificates issued by the Priorities Division of the War Industries Board; or

(2) After orders covered by priority certificates shall have been provided for or filled, then producers of pig-iron and of steel manufactured products may utilize such raw materials and manufacturing capacity, if any, as they may have available, to fill orders of their customers not covered by priority certificates, provided such orders are embraced within the schedule of purposes entitled to preference treatment as determined by the Priority Board as follows:

Ships, including destroyers and submarine chasers.

Aircraft.

Munitions, military and naval supplies and operations. Building construction for Government needs. Equipment for same.

Fuel for domestic consumption or for manufactured necessities named herein.

Food and collateral industries. Foodstuffs for human consumption and plants handling same. Feeding stuffs for domestic fowls and animals, and plants handling same. All tools, utensils, implements, machinery, and equipment required for production, harvesting, and distribution, milling, preparing, cannings, and refining foods and feeds such as seeds of foods and feeds, binder twine, etc. Products of collateral industries, such as fertilizer, fertilizer ingredients, insecticides and fungicides, containers for foods and feeds, collateral products, materials and equipment for preservation of foods and feeds, such as ammonia and other refrigeration supplies, including ice. [Including all necessary raw materials, partly manufactured parts, and supplies for completion of products.]

Clothing for civilian population.

Railroads or other necessary transportation equipment, including water transportation.

Public utilities serving war industries, Army, Navy, and civilian population.

Provided, however, whenever the Priorities Board shall have promulgated and certified for observance to the producers of pig-iron and steel manufactured products a revised preference list, no surplus material or capacity after filling or providing for all orders covered by priority certificates shall be used to fill non-priority orders save such as are placed by industries or plants embraced within preference lists; and

Provided, further, that each producer of pig-iron and of steel manufactured products shall at the end of each week, ending with midnight Saturday thereof prepare and forward to the Director of Steel Supply of the War Industries Board a detailed statement of all shipments made during such week not covered by such priority certificates.

Be it further resolved, That should any producer of pig-iron or of steel manufactured products have any surplus war material or manufacturing capacity after filling (*a*) all orders covered by priority certificates, and (*b*) all orders embraced within the schedule of purposes entitled to preference treatment or placed by industries or plants embraced within the revised preference list, after it shall have been promulgated and certified by the priorities board, then in such event such surplus materials or capacity may be disposed of by such producer or manufacturer to other customers subject to the approval in writing of the director of steel supply first had and obtained.

Be it further resolved, That the director of steel supply and a committee appointed by the American Iron and Steel Institute shall jointly make a careful study of the present and prospective iron and steel requirements of each and every department and agency of the Government of the United States and of its Allies, and the capacity of the iron-producing and steel-manufacturing plants of the United States to meet such requirements and present to this board as early as practicable (1) a report of their findings, together with (2) recommendations of measures, if any, which should be taken to stimulate and increase the production of iron and of iron and steel products in order to meet the direct and indirect

*Abstract of statement issued by the War Industries Board.

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war requirements and the demand of industries of exceptional or national importance in carrying on the War.

2. The Priorities Committee is now issuing certificates of three classes, namely, Class AA, Class A, and Class B. One effect of this resolution is to put orders not covered by priority certificates, but embraced within the schedule of purposes entitled to preference treatment, in a fourth class, designated Class C, and to give such orders priority and precedence over other orders not covered by priority certificates, which other orders will be designated Class D. If reasonably satisfactory delivery can be secured on Class C orders, no application for a higher priority rating should be made to the Priorities Committee.

3. Orders in Class D may be filled from surplus stocks, if any remain after orders covered by priority certificates or in Class C have been filled, subject, however, to the approval in writing of the director of steel supply. In order to avoid delays in the filling of small orders urgently required for essential civilian uses, the director of steel supply approves filling of such orders in Class D on the following conditions:

(*a*) That the order shall not exceed 5 tons.

(*b*) That the manufacturer shall, on or before the 10th of each month, report to the director of steel supply orders filled during the preceding month under this authority, and shall certify that he believes that it was in the public interest that such orders should be filled.

Applications for permit to manufacture or ship Class D orders which cannot be shipped under the foregoing authority must be referred to the director of steel supply.

4. The direct war requirements of iron and of iron and steel products of all departments and agencies of the United States government and of its Allies will be allocated to the various manufacturers by the director of steel supply. All other orders for direct and indirect war requirements for iron and iron and steel products should be placed by the consumer with his regular source of supply. In the event a consumer is unable to find a producer or manufacturer who will accept this offer, application for allotment should be made to the director of steel supply only when supported by evidence that the public interests requires the filling of the orders.

5. Jobbers dealing in plates, sheets, bars and shapes, structural shapes, tubular products, wire and wire products, tin plate, heavy hardware, farm implements, mining tools, machinery and equipment, oil-well supplies, and similar products should be permitted to maintain reasonable stocks from which Government agencies, war industries, and the civilian population may draw to meet essential requirements. Each jobber shall, not later than the 5th of each month, file with the director of steel supply a certified statement covering shipments made during the preceding month. If such shipments fall within priority Class AA, Class A, Class B, or Class C, or are covered by permits issued by the director of steel supply, the jobber shall be entitled to place orders for replacement of shipments so made. The manufacturer will, upon receipt of such order, scrutinize it in the light of the other demands to the supply generally and the particular requirements and demands for the prducts ordered in the territory served by the jobber placing the order, to guard against hoarding or an inequitable distribution of the supply available to meet all demands for essential uses. Orders for stocks placed in accordance with the foregoing rules shall be rated as Class B-4 and entitled to priority and precedence accordingly.

5. No application for a license to export iron or iron and steel products (save on direct orders to the United States and its Allies) should be made to the War Trade Board unless the orders fall within priority Class AA, Class B, or Class C, or are covered by a permit by the director of steel supply.

Standard sizes of pneumatic automobile-tires have been established by the War Industries Board, after consultation with the directors of the National Automobile Chamber of Commerce, the Tire and Rim Association, and the tire and rim division of the Standards Committee of the Society of Automotive Engineers. Tires are divided into five classes. Class A comprises 3½ by 30-in. and 4 by 31-in. clincher, plain, and non-skid, and 3½ by 32-in., 4 by 33-in., 4½ by 34-in., 5 by 35-in., 6 by 36-in., 7 by 38-in., and 8 by 40-in. straight-side, plain, and non-skid. Manufacture of tires in class A is to be continued. Class B comprises 3 by 30-in., clincher, plain, and non-skid; 5 by 35-in. quick-detachable and non-skid; 5 by 37-in. straight-side and non-skid; and 4 by 32-in., 4 by 34-in., 4½ by 32-in., 4½ by 33-in., 4½ by 35-in., and 5 by 33-in. straight-side, plain, and non-skid. Manufacture of tires in class B must be discontinued not later than November 1, 1920. Class C comprises 4½ by 33-in. and 4½ by 36-in., straight-side plain-tread, 4½ by 36-in. straight-side non-skid tread, and 4½ by 35-in. and 5 by 37-in. quick-detachable non-skid tread. Manufacture of tires in class C must cease not later than November 1, 1919. Class D includes 3½ by 30-in., 4 by 35-in., 4½ by 29-in., and 4½ by 37-in. straight-side non-skid tread; 4½ by 32-in., 4½ by 33-in., and 4½ by 34-in. quick-detachable non-skid; 5 by 33-in. straight-side plain; 3½ by 32-in. and 4 by 33-in. quick-detachable non-skid, and clincher non-skid; and 4½ by 36-in. quick-detachable straight-side plain. Manufacture of tires in class D must be discontinued not later than November 1, 1918. All other types and sizes of tires have been placed in class E and their manufacture has already been discontinued.

The lumber cut in the United States during 1917 is estimated by the U. S. Forest Service at 35,831,239,000 ft. B.M. The four leading States were Washington, 4,570,000,000 ft.; Louisiana, 4,210,000,000 ft.; Oregon, 2,585,000,000 ft.; and Mississippi, 2,425,000,000 ft. The leading species was southern yellow pine, with a total cut of 13,539,464,000 ft., or 37.7% of the total amount produced. Next comes douglas fir, with 5,585,000,000 ft., and then white oak and white pine, with 2,250,000,000 ft. each.

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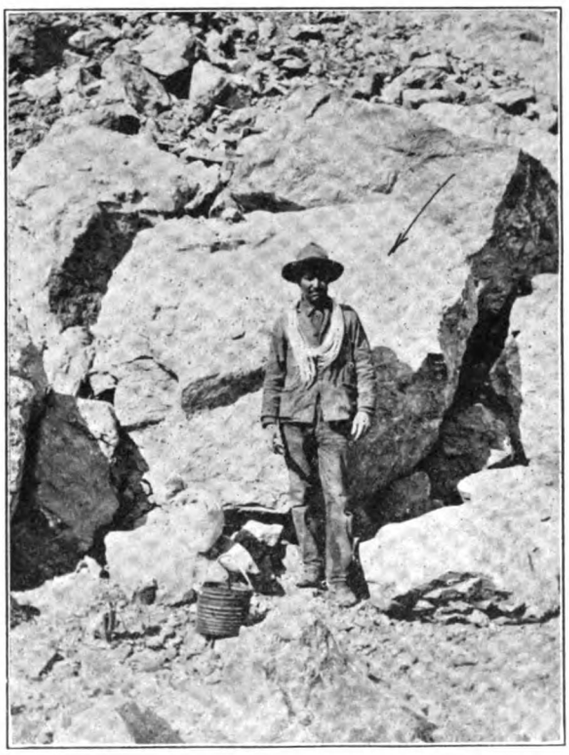
Blasting Methods at Ajo.

By S. U. CHAMPE

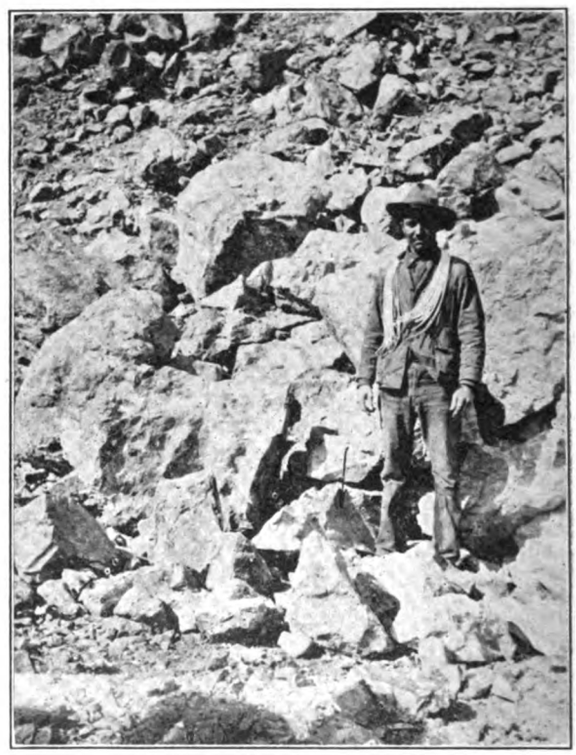
In the work of excavating the ore in the Copper mountain deposit at Ajo, Arizona, belonging to the New Cornelia Copper Co., two methods of preparing the ground to receive the charges for blasting are employed. One method is to tunnel into the working-face on a level with the floor of the shovel-pit, and the other is to drill vertical holes about six inches in diameter with No. 14 Cyclone gasoline drilling-machines. Before the blasting is done, the ground is closely examined and a careful stadia survey is made to determine the toe and crest of the working-face and the proper situation for the powder-chambers. An effort is made to ascertain the positions of the faults and also of the solid and loose material. The effect of these features on the result of the blast is anticipated. From the data thus secured a plan is drawn, and from this map a sufficient number of cross-sections is plotted to calculate the tonnage that will probably be broken by each charge of powder.

For a working basis, each pound of Trojan 40% powder is taken as having sufficient strength to break four tons of ore. This, no doubt, is an under-estimate of the strength of the powder, but it has proved advantageous to slightly overload the holes. This practice, to a degree, prevents the broken ore from hanging on the faces and from developing slides, which are dangerous to life and equipment, and are expensive to shoot down. In actual practice 3.44 tons of ore have been broken for each pound of powder used, including that required for 'springing' or chambering the churn-drill holes. This figure was determined from accumulated records of the blasting of 530,600 tons of ore. The ore weighs about 160 lb. per cubic foot.

By the tunnel-method, the tunnels are driven into the face to a depth equal approximately to two-thirds the height of the ore above the powder-charge. From the main tunnels two sets of cross-cuts are made, one set at the rear of the tunnel and the other about 30 ft. back from the portal. The cross-cuts are driven to such a distance as will make the charges in the rear an equal distance apart for all tunnels. Two powder-chambers, one at each end of the cross-cut, are excavated in the back. In the front cross-cut four chambers are used. The powder-charges are placed about 6 ft. below the floor of the pit. About 20% of the total amount of the powder in each tunnel is placed in the front charges. These figures apply to ideal conditions only. Allowances are made for faults, hard and loose material, height of bank, and other things, so that the amounts of powder may be



BLOCK BEFORE BLASTING



BLOCK AFTER BLASTING

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proportioned accordingly. The advantages of the tunnel-system are: No springing is necessary before placing the powder-charges; the danger of premature explosions from hot walls, caused by chambering with powder is eliminated; the work can be done with less skilled labor; it is not necessary to build roads over difficult surfaces for the movement of heavy drilling-machines. On the other hand, tunneling into a low bank is as expensive as tunneling into a high one. When this method is used in banks less than 50 ft. high, the cost per ton of ore broken has been found to exceed the average.

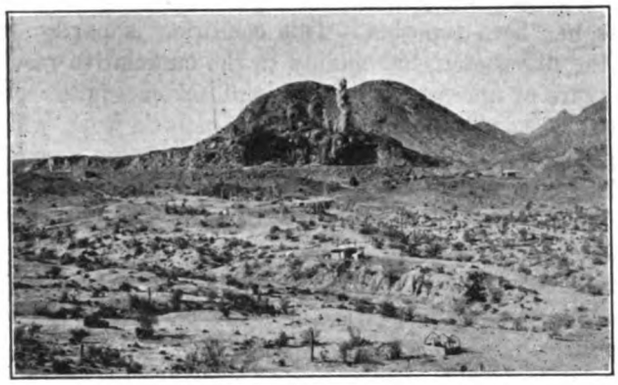

FIG. 1. COPPER MOUNTAIN THE DAY BEFORE BLASTING

FIG. 2. VIEW AT THE MOMENT OF BLASTING

Churn-drill holes are placed about 50 ft. apart and are drilled to a depth of 6 ft. below the floor of the pit. After using different methods, the mine superintendent, Fred Eckman, is now using the following procedure when chambering churn-drill holes:

1. Use 28 sticks of powder, without tamping, to blow the hole dry, that is, to drive out the water.

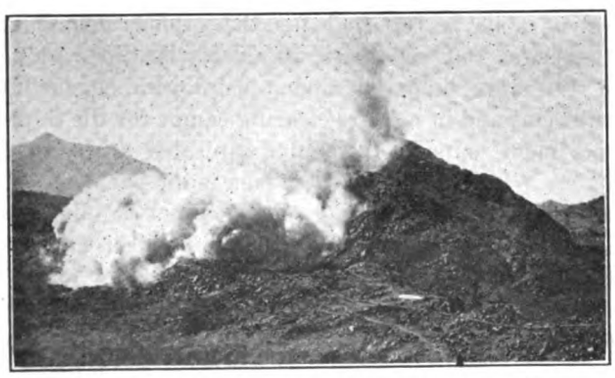

FIG. 3. APPEARANCE OF HILL FOUR MINUTES AFTER BLAST

2. Load the hole with 25 lb. of powder and 15 ft. of tamping. This charge is to enlarge the bottom of the hole to receive the final shot for chambering.

3. Load the hole with one-tenth the amount of powder that is to be used in the blast. If the hole is to be loaded with 80 boxes of powder then use 8 boxes for the chambering-shot; if 100 boxes are to be used, then 10 boxes will be required for chambering. About 40 ft. of tamping is used over the final chambering-shot. After each shot, time must be allowed for the walls of the hole to cool. Repeated tests of temperature are made by lowering a self-recording thermometer into the hole.

There are advantages in using churn-drills. The work can proceed without interference to steam-shovel operations, and where the working-space is limited greater quantities of ore can be prepared for blasting than with the tunnel-method. It is not necessary to wait until the ore already shot down is removed before the work of drilling for the next blast can proceed. Churn-drills have proved exceedingly satisfactory where the working-faces are not over 50 ft. high.

On account of the extreme hardness of the ore in the Ajo district, it has been found that after a depth of 40 or 50 ft. has been passed the cost per foot of hole drilled rapidly increases.

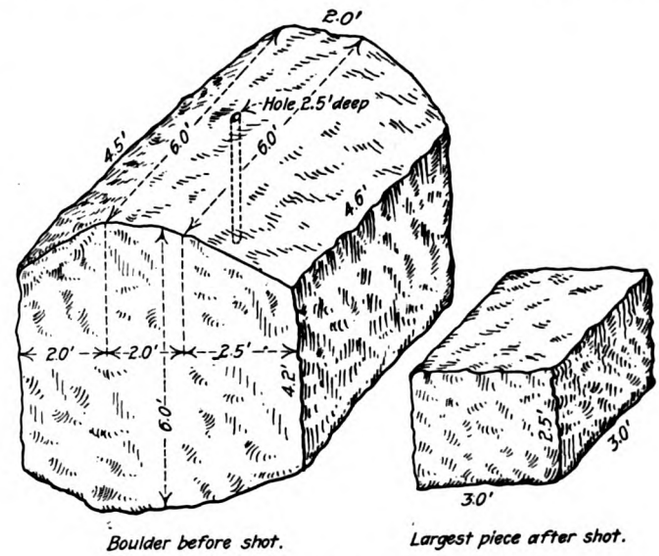

DIAGRAM REPRESENTING BLOCK-HOLING

In the process of excavating the ore in Copper mountain, it was estimated that 200,000 tons of ore was broken by a single blast. This was on February 28, at what is called 'No. 3 hill.' Seven holes were drilled with a churn-drill, each hole being six inches in diameter and 90 ft. deep, spaced 50 ft. apart. A total of 32 tons of 40% Trojan powder was used in the blast. That includes the powder used for springing. The appearance of the hill, as it stood the day before shooting the holes, is seen in Fig. 1. The illustration in Fig. 2 was taken at the moment of the blast, and Fig. 3 shows the effect

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as revealed when the smoke had cleared away four minutes later.

All block-holing at Ajo is now done with the same grade of Trojan powder. The practice is illustrated in the accompanying cut and half-tone illustrations. In this particular case a block measuring approximately six feet in all three dimensions was drilled in the centre of one side to a depth of 2 ft. 6 in. Block-holes are loaded with two ounces of the granulated 40% Trojan powder. A fuse split at the end, and without a detonating cap, is next inserted, after which another two ounces of the powder is poured in and lightly pressed down with a wooden tamping-stick. The remainder of the hole is then tamped full of screened sand, and the charge is ready for shooting. In all cases the results are practically the same: the boulder immediately around the hole is completely shattered, while the lower half is split into pieces, the largest of which, in the case cited, is shown on the diagram.

Mexican labor is used for this work. One man with an Ingersoll-Rand BCR-430 jack-hammer can drill 100 holes, averaging 18 in. deep, in eight hours, making all his own air connections. These, as well as the powder-men for this work, are picked men, working most of the time without the direct supervision of a foreman.

The drawing shows a common size of boulder in which four ounces of powder is used. If, by inspection, a boulder is approximately half as large, then only two ounces would be used; if twice as large, eight ounces would be required, and so on. At present the powder is stored in two stone buildings, one with a capacity of 200 tons, and one of 100 tons capacity, both about half a mile from the present steam-shovel pits. To date this has proved ample storage capacity for the amount of reserve powder required.

The city of Los Angeles has an area of 362.04 square miles, or considerably more than that of any other municipality in the United States. The total length of dedicated streets is 2713.58 miles, of which 439.05 miles, or 18.1%, is paved, and 724.42 miles, or 26.7%, is otherwise improved. There are 931 miles of sanitary sewers. The cost of sprinkling streets by horse-drawn vehicles was $1.05 per mile and by motor-driven vehicles, $0.91 per mile. The total cost of street improvements during the fiscal year was $1,547,951, of which $770,782.95 was for paving, grading, oiling, and curbing, $575,200 for sanitary sewers, $45,043 for storm-drains, and $155,926 for bridges and other structures.

A 4700-ton wooden ship, the 'War Mystery,' was recently launched at a Texas yard. The vessel required only 1,500,000 ft. B.M. of timber. Frames of built-up timbers were used in its construction, scarfed and held together with hardwood tree-nails driven by pneumatic hammers. Outside of the frames was nailed a double layer of 1¼-in. boards placed diagonally and at right angles to each other. Outside of these two layers of diagonal planking was placed longitudinal planking, varying in thickness from 4¾ to 8 inches.

TROPICAL SANITATION

Canal Zone sanitation was good during the first quarter of 1918, according to an official report. Malaria, which is the most important problem of the health department, has been almost extinct in the regular sanitated areas. Many weeks have passed during which no case has been reported. This condition is partly due to the dry season, but mainly to the cumulative results of years of unceasing vigilance and anti-mosquito work, classified as permanent work. Anti-malaria work, which consists of anti-mosquito work, is like fighting a smouldering fire which, if not constantly watched, may flare-up at any time the conditions become favorable. Such will be the case until the malaria parasite or its host is eliminated. Theoretically it is possible to eliminate the parasite causing malaria—more practicable than to eliminate its host, the anopheles mosquito. Elimination of the latter would involve the expenditure of enormous sums of money. Elimination of the parasite could be done by treating all human beings who are infected. The latter method of procedure is also expensive, but must be the goal sought, when, as with yellow fever, there shall be no more sources of infection. The 'aedes calopus' (stegomyia) still exists in Panama, but there has been no case of yellow fever for years. In the meantime the anti-mosquito work must go on as a local measure. The present corps of sanitary inspectors is deserving of great credit. The regular inhabited areas are in better condition than ever before. During the past quarter much permanent work has been done, consisting of additional sanitary ditches ad tile-drains. The total number of cases of malaria reported for the period, among employees, was 160. Of these, 20 are for the Zone proper, and 140 have occurred among employees engaged on plantations and in pasture-clearing camps for the Supply Department, outside of regular sanitated areas, in the jungle. What to do with these men is the problem. The breeding places about these camps cannot be eliminated on account of the temporary nature. The men employed are mostly native Panamans and Colombians, many of whom are 'carriers,' and furnish infected blood to the 'anopheles' mosquitoes, which, in biting 'non-immunes,' cause active malaria fever. It has been suggested that the streams near the camps be left shaded, that is, that vegetation be left uncut, making breeding of 'anopheles albimanus' unfavorable. The favorite breeding place of these insects has been found to be in water exposed to sunlight, especially where certain species of green algæ grow, and where fresh vegetation has been felled along the edge of the stream. It has further been found that 'anopheles malefactor' has not been incriminated as a host for malaria parasites, and thereby becomes of secondary importance. In each of these camps the district sanitary inspector has a trained 'mosquito catcher' who catches all mosquitoes found within the mosquito bars, removing a prolific number of infected mosquitoes. A large number of the bars in use at these camps are too short and do not furnish adequate protection.

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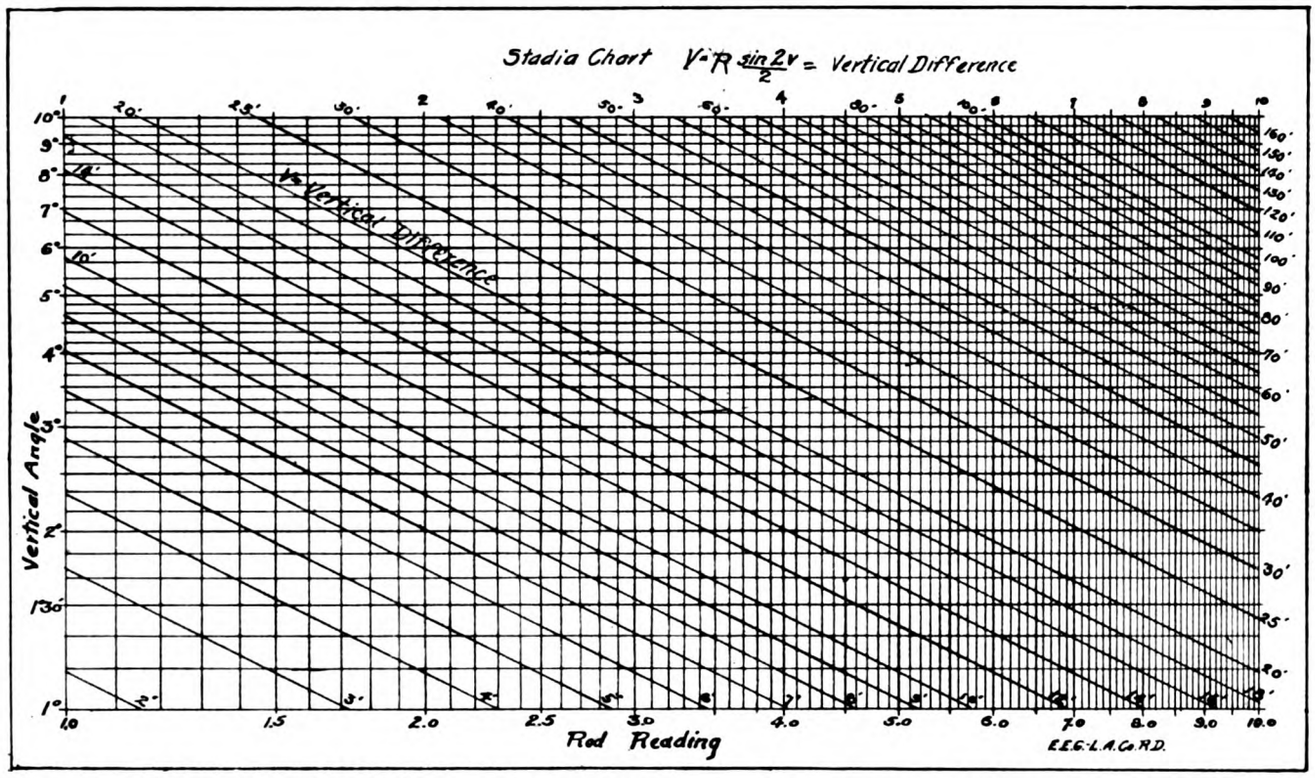
Engineers' Note Book

STADIA-REDUCTION CHART

By E. Earl Glass*

The method of using the accompanying chart is self-

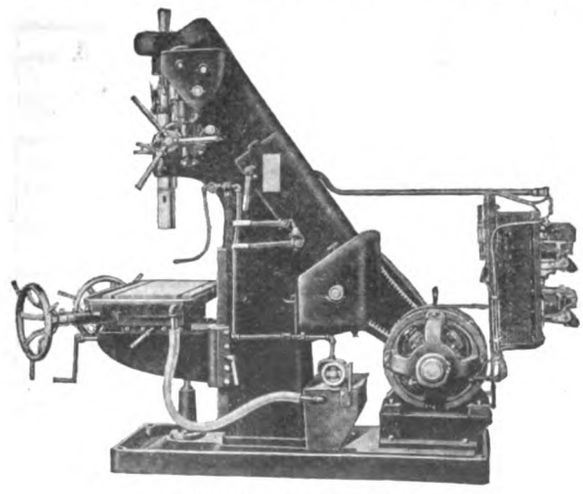


evident. Thus for a rod-reading of 3.5 ft. and a vertical angle of 2, the vertical difference is 12 feet.

Industrial Progress

MOTOR-DRIVEN DRILL AND TAPPER

To speed up production without danger to machine or operators is the purpose of the new Barnes self-oiling, all-geared drill and tapper, which handles high-speed twist-



HARNES DRILL AND TAPPER

drills from ¼ to 2 inches. This is a manufacturing machine, built for heavy-duty work and rapid production. Belts are eliminated, all power being transmitted through gears. With the exception of the spindle-sleeve and cross-spindles, bearings and gears are continuously lubricated by an automatic self-oiling system. The oil for this purpose is pumped from the reservoir at the base of the machine by a geared pump. Eight changes of speed are provided, with control levers within easy reach of the operator from his position in front of the drill. The spindle may be stopped by placing the shifter-lever on the neutral position, or by throwing out the clutch-gear. All transmission-gears except the friction-clutch gears, are cut from special high-grade chrome-nickel steel, heat-treated, and tempered to prevent wear, and to increase strength and stiffness. There are ten instant changes of geared feeds, controlled by levers in front of the operator. The feeds are indicated on an index dial-plate. All important feed-gears are cut from steel and are case-hardened. A safety-collar protects the machine against damage from overloads.

For tapping, the machine may be equipped with an automatic reversing mechanism. A trip can be set so that the instant the tap reaches the depth required, the spindle will reverse automatically. It is also possible to set the shifting-lever so that when tripped, either automatically or by hand, it will return to the neutral position, thus stopping the spindle instantly instead of reversing it. A small hand trip-lever is always ready for use if it is desired to stop or reverse the spindle at any point in the operation. These machines are driven through a silent chain by a Westinghouse 10-hp. direct-current motor provided with a Westinghouse automatic starting-panel. This panel is shown exposed in the illustration but is provided with a metal case when desired. All gears are enclosed, meeting the requirements of modern safety laws.

CONCRETE SHIPBUILDING

By C. K. Forner

All large concrete vessels should be built bottom up to facilitate construction and to make possible a clean-cut

*Monrovia, California.

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finish for the outside of the hull, which will ensure greater speed for the vessel without additional power. After the concrete is cast and properly cured, the vessel should be launched sidewise to facilitate the turning-over movement in the course of launching from the ways. After the vessel is launched and righted, the hatchways may be cut through the deck for the removal of the interior bracing and forms, and the inside of the hull given a neat finish and made ready for the machinery. The extra cost of this method would be small and would be more than balanced by the advantages.

Building a concrete vessel bottom up, with the necessary bracing and forms to support the shell, gives the desired support to the vessel necessary to withstand internal stresses during launching, and which ensures the vessel against the possibilities of breakage more readily than for vessels built right side up.

Several concrete vessels have been built bottom up in Sweden and Norway, but it was necessary to pump the water from the air-tight compartments in order to float the vessel after launching. I do not see the necessity of this, since to deck the complete vessel with concrete and to cut through the deck as above stated, is simple. By this procedure no water can enter the vessels.

Certain materials have been found, which, when properly graded and mixed with cement, will give a much greater strength than concrete made of ordinary aggregate. These materials can be had in abundance and will enable the concrete shipbuilders to cut down the dead-weight tonnage and bring the ratio of displacement nearer to that of steel vessels. As these materials make a dense concrete, the extra cost of waterproofing can be eliminated without danger of damaging the vessel.

In order that the best possible results may be derived by the use of cement, three fundamental principles must be regarded. Although these principles are simple and should be generally known it is essential that attention be called to them.

1. Aggregate must be clean and free from silt, clay, or inferior stone.

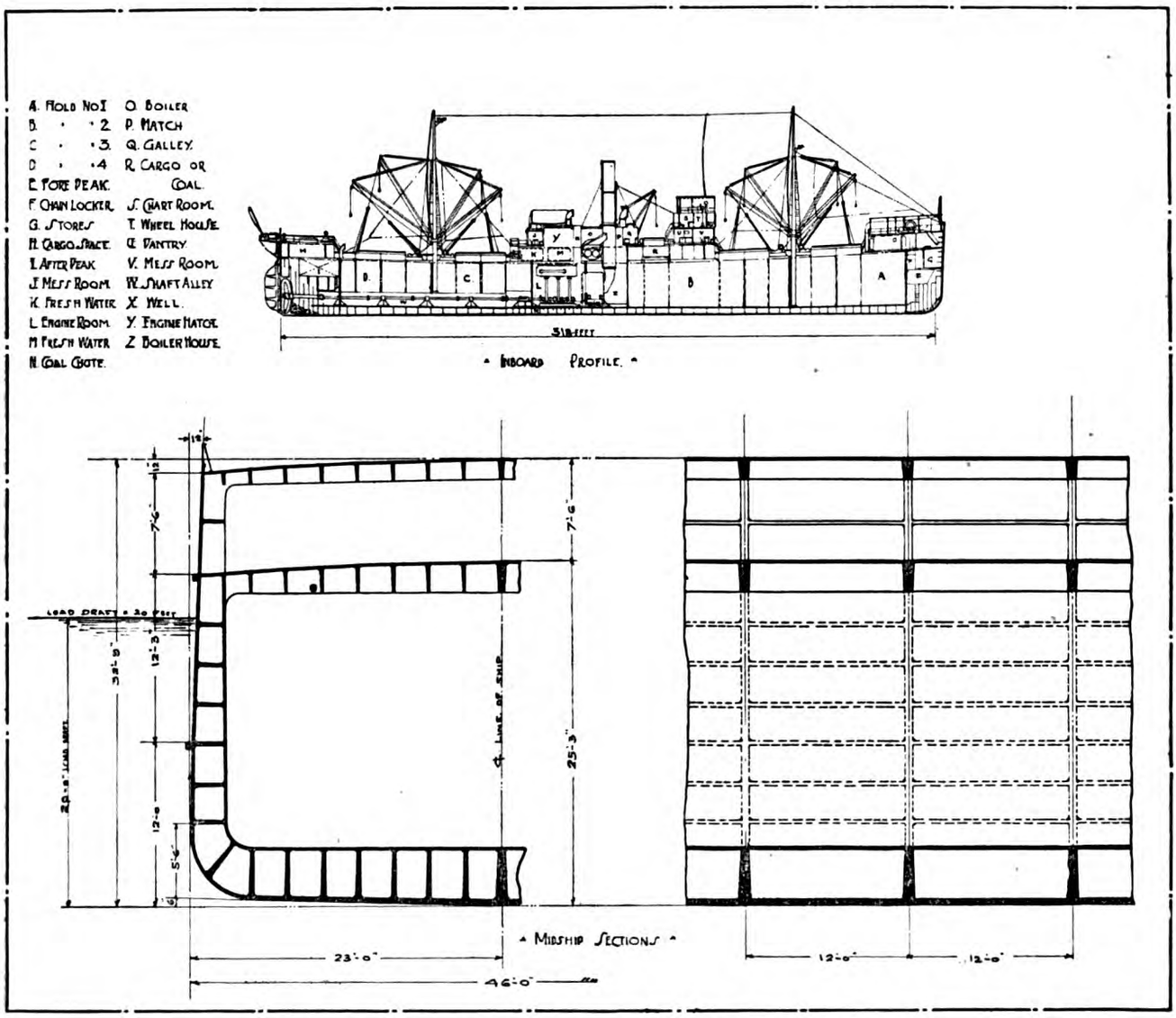
2. Materials used must be such as to permit of expansion and contraction without rupture.

3. Products must be cured by keeping moist for at least 21 days after made.

For concrete ships, I would recommend the following mixtures, preferably the second:

1. For a mixture of pit-sand and gravel, not more than 1½ parts of aggregate passing through a ½-in. screen should be used to 1 part cement and ¾ part water.

2. For a mixture of crushed and ground rock, not more than 2 parts of aggregate passing through a ¼-in. screen should be used to 1 part cement and 1 part water.



Design for Concrete Ship prepared by Mr. Forner in 1909.

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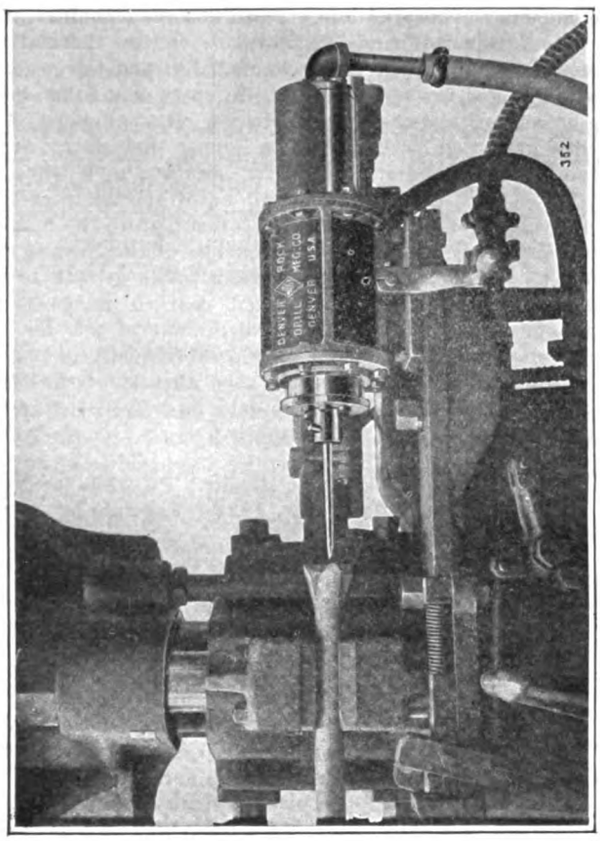
THE MODEL 10 'WAUGH' DRILL-STEEL PUNCHER

The puncher shown in the illustration is a unique and efficient little pneumatic device that is now being put forth by the Denver Rock Drill Manufacturing Co., Denver, Colorado, as an attachment to its model 8 sharpener. Its purpose is to open the hole in the end of a piece of drill-steel while being worked into a bit, collar, or lug. The punch is held in a tappet-chuck. This chuck and a hammer are set



A DRILL-STEEL PUNCHER

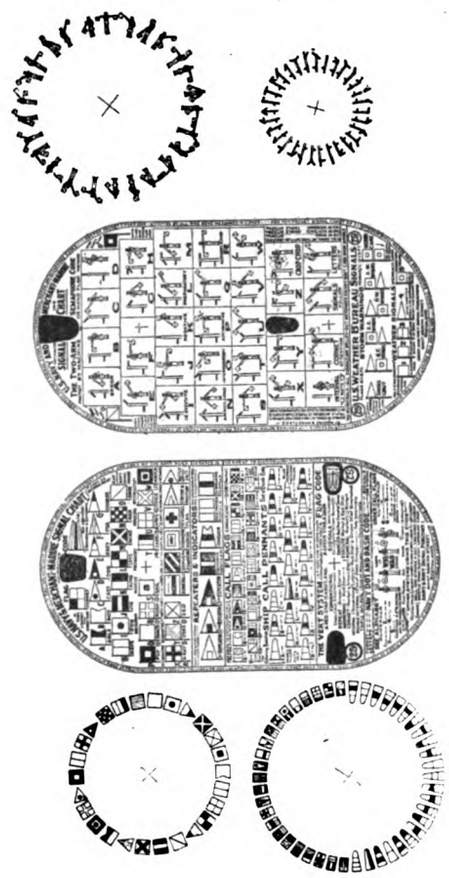
in an air-feed cylinder. When opening up a water-hole the punch is simultaneously hammered and fed forward into the steel. The action of the hammer and air-feed cylinder are controlled by a single handle. The device will open a bit or shank in one-tenth the time required to perform the operation by hand. Where such an arrangement is desirable it may be mounted separately or even adapted to other sharpeners.

The National Tube Co., Pittsburgh, Pennsylvania, calls attention by an illustrated circular to the progress that it has made in 28 years in the production of steel pipe. It is interesting to note that steel pipe was first made in this country in 1887, the first year's output being about 300 tons.

SHIP-SIGNALS AND SIGNAL-CHARTS

The international signal-code is the basis of mercantile signaling, and is in general use. The U. S. Navy, however, uses three codes in addition to this, namely: the flag code, the dot-and-dash code, and the two-arm semaphore-code.

The Army and Navy Signal Publishers, of Boston, are publishing a signal-chart, as shown in the illustration, which is one-third the size of the original. This chart shows, in the proper colors, the flag-code with repeaters and indicators, call-flags, ship-call pennants, the Very system, the Navy dot-and-dash code, the two-arm semaphore-code by the machine or the hand-flag method, weather signals, etc. A book explaining the chart is sold with it.



SIGNAL-CHART

Book Review

Concrete Engineers' Handbook. By George A. Hool and Nathan C. Johnson. 867 pp. Ill, index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $5.

This is probably the most complete and up-to-date treatise on concrete and reinforced concrete that has appeared, covering both theoretical design and construction practice. While some use is made of the material in Hool's 'Reinforced Concrete Construction,' the scope of the present volume is broader. The first chapter discusses materials for both plain and reinforced concrete. The next two chapters are devoted to methods of construction and to construction plant. Then comes a chapter, which might appear to be out of its logical order, on floors, sidewalks, and pavements. Properties of mortar, plain concrete, and reinforced concrete are then considered. The authors then lead up to the design of buildings through the divisions of beams and slabs, columns, bending and direct stress, and moments in building-frames. Foundations and retaining-walls are then discussed, and then slab and birder bridges, and floors and abutments for steel bridges. The chapter on arches considers also arch bridges. The chapters on hydraulic structures includes under this title, dams, reservoirs, stand-pipes, tanks, and culverts. The two final chapters are devoted to miscellaneous structures and to estimating. Appendixes contain standard specifications for cement, building regulations, and similar data, also a brief

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discussion of concrete-ship construction. The book is well illustrated and there is a good index.

Powdered Coal as a Fuel. By C. F. Herington. Pp. XI-211, 84 ill., index. D. Van Nostrand Co., New York, 1918. For sale by 'Mining and Scientific Press.' Price, $3.

The use of pulverized coal is expanding with great rapidity. The efficiency obtainable, as compared with coal burned in the ordinary way, is so great that it offers the fuel engineer an opportunity to still further decrease the cost of generating steam, and the smelter an opportunity to largely augment the capacity of his furnaces. When it is realized that steam engineering has advanced to such a point that two years ago, at the costs then prevailing, it was possible to ship bituminous coal as much as 200 to 300 miles from the mines to the Atlantic coast and to burn the run-of-mine under boilers with the aid of automatic stokers, and convert the power developed into electric energy at a cost of about 0.4c. per kilowatt hour at the switchboard, it will be seen that the added efficiency of burning the coal in the pulverized form will long sustain the steam-plant as a competitor with hydro-electric installations. Although powdered coal was employed for burning cement clinker as much as 40 years or more ago, it is probably not an over-statement to say that the development of the art is still in its infancy. This finds substantiation in the fact that the engineers who have written upon it seem to have no exact idea of the character of the new physical conditions that are created when the coal is reduced to a fine state of subdivision, although they recognize that some marvelous change has taken place. Until the nature of a substance is completely comprehended the most intelligent adaptation of it to industrial use is not possible. It is true that the combustibility of coal, that is, its rate of combustion, increases in proportion as the superficial area is extended by fine-grinding. The smaller the particle the greater its specific surface, as every mathematician knows. If this be continued until the smallest particle that can be produced mechanically has been reached, this minimum dimension yields what is called a colloid. It consists of an aggregation of only a few molecules, and in that state the original nature of the material in some notable respects has become fundamentally changed. Suspended freely in a medium the particles will be found to possess erratic movements of their own, quite unrelated to the effect of gravity. Moreover, such particles condense upon themselves large quantities of certain gases. This is the phenomenon of adsorption, and in the case of coal or other carbonaceous colloids the oxygen is preferentially adsorbed, until the gas, to the extent of many times the volume of the particle, is thus condensed upon it. Under these circumstances it will appear why the velocity of chemical combination between the carbon of the colloid and the associated oxygen takes place at such a high velocity. Herein also lies the explanation of the fact that carbonaceous colloids, under some conditions, develop explosive energy. This occurs, apparently, when the amount of air holding it in suspension is such that practically the total quantity of oxygen contained therein becomes adsorbed. Beyond this volume no more oxygen can be condensed, but, the dilution of the mixture being greater, the separation of the particles is wider, so that the velocity of the combustion is retarded; to state it otherwise a detonating wave then cannot develop because it cannot be transmitted on account of the gap between the particles. In crushing coal, as practised today, only a fraction of it becomes subdivided to colloidal dimensions, and it is evident that enormous possibilities exist for improvement in such details as the methods of preparation, determination of the conditions favoring maximum adsorption of oxygen, the admixture with air for feeding into the combustion chamber, and similar problems. The volume written by Mr. Herington treats these theoretic features lightly. For information of that kind the reader must resort to periodical literature, for it has not yet become crystallized in book form, and much remains to be investigated in our research laboratories. The thing, however, that Mr. Herington has done, which is an important achievement, is to discuss correctly and fully the present state of the art. On this account, and because he gives the detail so abundantly, the work is of great value. He tells what coals yield the best results under the existing systems of handling it, how the coal is crushed, the efficiency of a large number of different machines, costs of preparation, influence of moisture on the thermal efficiency, how to dry the coal economically, and the practical means adopted for successful feeding in cement kilns, boiler fire-boxes, and reverberatory furnaces. His summary of the earlier use of pulverized coal in copper metallurgy at the plants of the Canadian Copper Co., and at the Washoe Reduction Works, at Anaconda, will be of special interest to mining engineers. The book was issued before the brilliant success recently achieved at the smelter of the Nevada Consolidated Copper Co., at Ely, Nevada. The growth of this practice of firing with pulverized coal in reverberatory copper-smelting bids fair to drive oil out of use for that purpose. The data collected in this volume will be of great value to engineers who wish to keep abreast of the times. It gives the practical facts necessary as a preliminary to a more exhaustive study of the subject. C. DeK.

Coal Catechism. W. Jasper Nicolls. Pp. 249, index. J. B. Lippincott Co., Philadelphia, 1918. For sale by 'Mining and Scientific Press.' Price, $1.50.

This handy little book is a reprint from an edition published originally in 1915, and is in fact a development from a catechism that has been before the public since 1898. Such continued demand shows that it fills a want. Mr. Nicolls is a member of the American Society of Civil Engineers, and is a thoroughly competent authority; in addition he possesses the unusual merit of being able to explain that which is essential as an answer to pertinent questions that could be propounded by any bright person. This is the peculiar quality of mind required for presenting knowledge in the form of a catechism. As a short and easy course to a considerable volume of information regarding the occurrence of coal, the mining of coal, and problems of distribution, together with the elementary theory of heat, and of power-development, the book is to be commended. The chapters on metallurgic uses, gasification, and coke are quite satisfactory, but we regret that he has not added a chapter on pulverized coal and an extension to his chapter on by-products in coking, considering the recent interest in those subjects. The book will continue to be useful.

The Elements of Coal Mining. By Daniel Burns, London. Pp. 236, ill., index. Longmans, Green & Co., New York, 1917. For sale by 'Mining and Scientific Press.' Price, $1.10.

In the writing of elementary treatises upon technical subjects the English practitioners possess a peculiar knack, which generally gives a high practical value to their productions. This praise may be justly bestowed upon the neatly printed and well illustrated book before us. It is distinctly elementary, but it deals with the problems that arise in everyday operations, and tells how to overcome the difficulties that are encountered. It is a book that will be appreciated by those having to deal with coal, and it also will be found suggestive in many details regarding mining methods applicable to metalliferous deposits; this applies particularly to methods of laying out coal-veins for exploitation, of supporting roofs and sides, and of ventilation. The chapters dealing with handling water and with winding appliances are most useful.

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Personal

F. C. Black has been appointed city engineer of Hoquiam, Washington.

E. H. Jeffries has been appointed city engineer of Manteca, California.

J. F. O'Connor has announced his candidacy for the office of county surveyor of Nevada county, California.

Roy S. Bonsib has been appointed safety engineer for district No. 7 for the Emergency Fleet Corporation.

E. E. Calvin has been appointed Federal manager for the Union Pacific Railroad, with headquarters at Omaha.

Ernest Rolison has been appointed city manager of Redding, California. Mr. Rolison was formerly city electrician.

Charles de St. Maurice has announced his candidacy for the office of county surveyor of Colusa county, California.

J. J. Rosenthal, engineer for the Industrial Accident Commission of California, has changed his name to **J. J. Rosedale.**

O. H. Fischer, president of the Union Gas Engine Co. of Oakland, has been re-elected president of the National Gas Engine Association.

W. B. Storey has been appointed Federal manager for the Atchison, Topeka & Santa Fe Railroad, with headquarters at Chicago.

Ernest E. Howard, of Kansas City, is making an investigation of the safety of the various bridges across the Willamette river at Portland.

J. H. Rosseter, formerly vice-president and general manager for the Pacific Mail Steamship Co., has been appointed director of operations for the U. S. Shipping Board.

G. A. Strand, formerly city engineer of Eureka, California, has joined the engineering staff of the Trojan Powder Co. He has been succeeded by **Harry H. Hannah.**

Alvin Horwege, formerly city engineer of Petaluma, California, has resigned to become assistant engineer for the Emergency Fleet Corporation, with headquarters at Alameda.

Robert L. Hague, superintendent of engineering for the marine department of the Standard Oil Co. of California, has been appointed chief of steel construction for the Emergency Fleet Corporation. Mr. Hague's district will comprise the entire Pacific Coast.

Joseph H. Dyer, formerly assistant general manager of the Southern Pacific Railroad, with headquarters at Portland, has been appointed general manager of the combined Southern Pacific and Western Pacific Railroads.

Irving Worthington, formerly assistant engineer for the Fresno Canal & Land Corporation, has been appointed chief engineer for the Federal Farm Loan Bank at Spokane, Washington. He has been succeeded by **I. H. Teilman.**

William Sproule has been appointed Federal district manager for the railroads south of Ashland, Oregon, and west of Ogden, Salt Lake City, Albuquerque, and El Paso. Mr. Sproule has been president of the Southern Pacific Company. His headquarters will be at San Francisco.

Henderson W. Knott, formerly general manager for the Morgan Crucible Co., has been appointed by the United States Fuel Admisinstration to take charge of measures for saving fuel in power-plants throughout the country.

Paul Shoup, president of the Pacific Electric Railway, has been appointed vice-president of the Southern Pacific Co., and as such will be at the head of the Associated Oil Co. and other subsidiary corporations of the Southern Pacific Company.

P. B. Findley, formerly technical editor in the department of publicity of the Westinghouse Electric & Manufacturing Co., is leaving to enter the Signal Corps Training School at the University of Pittsburgh, where he will take a special course in radio work.

George B. Sturgeon has moved his offices from the Sharon Bdg. to the First National Bank Bdg., San Francisco, where he will specialize on irrigation, drainage, water-supply, and highway work. Mr. Sturgeon was for ten years engineer in charge of construction at the University of California.

George E. Field, who was engineer in charge of construction of the dam on the San Juaquin river at Friant in 1883 for the Herndon project, has returned to Fresno and will engage in farming. The Herndon project included the construction of a high-line canal and would have irrigated a large area of land that is even yet being 'dry-farmed'. It failed, partly through lack of funds, and partly because of being generally ahead of the times. Since 1883 Mr. Field has been engaged in engineering work in many parts of the world.

Engineering Societies

A joint meeting of the San Francisco sections of the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Institute of Electrical Engineers, and American Chemical Society was held July 23 at the Engineers' Club to meet Alfred D. Flinn, secretary of the Engineering Council, who addressed the meeting on 'Co-operation Among Engineers and Engineering Societies.'

Mr. Flinn discussed the various agencies for co-operation among engineers that have already been established in New York, including the United Engineering Society, Engineering Societies building, the Engineering Foundation, the Engineering Council, the John Fritz medal, and the United Engineering Societies Library. The Engineering Societies building was the gift of Andrew Carnegie and was first occupied in 1906 by the American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Mining Engineers. In 1916 these organizations were joined by the American Society of Civil Engineers. At present 17 engineering organizations have offices in the building and 14 others hold meetings there. The total membership of these organizations is about 60,000. The Engineering Foundation was established by Ambrose Swasey in 1915. The first work of the Foundation was the organization and support of the work of the National Research Council. This work has been of great value to the Government, particularly since the United States entered the War, and it was taken over by the Government recently. Plans for future work by the Foundation include industrial as well as scientific research. The Engineering Council is composed of four representatives from each of the four principal National engineering societies, four from the United Engineering Society, and representatives from other societies that wish to join in and share the expense of the work of the Council. As the Engineering Council was organized only a short time before the United States entered the War, most of its activities have been in connection with war-work, such as the investigation of inventions and the listing and recommending of engineers for Government work, both civil and military. The Engineering Societies library contains 130,000 books and pamphlets, and through searches, and the preparation of copies and translations, is of service to engineers living at a distance from New York as well as those near the city.

At the conclusion of Mr. Flinn's address, a motion was carried recommending that the officers of the various local sections of the National societies confer and prepare plans for co-operation among engineers in the San Francisco Bay district.

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Market Prices

Iron and Steel Products

(Prices July 24, f.o.b. Pittsburgh, unless otherwise noted)

Bessemer pig-iron, per ton	$36.60
Basic pig-iron, per ton	33.40
No. 2 foundry pig-iron, 1.75 to 2.25% silicon, per ton	34.40
Malleable, per ton	34.90
Bessemer steel billets, per ton	47.50
Bessemer sheet bars, per ton	51.00
Open-hearth steel billets, per ton	47.50
Open-hearth sheet bars, per ton	51.00
Steel bars, per 100 lb	2.90
Iron bars, Cleveland, per 100 lb	3.64
Beams, per 100 lb	3.00
Tank-plates, per 100 lb	3.25
Sheets, black, No. 28 gauge, per 100 lb	5.00
Sheets, blue annealed, No. 10, per 100 lb	4.25
Sheets, galvanized, No. 28, per 100 lb	6.25
Wire nails, per 100 lb	3.50
Plain wire, per 100 lb	3.25
Galvanized wire, per 100 lb	3.95
Barbed wire, painted, per 100 lb	3.65
Structural rivets, per 100 lb	4.40
Boiler rivets, per 100 lb	4.50
Cast-iron pipe, class A, 4-in., Birmingham, per ton	59.00
Cast-iron pipe, class B, 4-in., Birmingham, per ton	58.00
Cast-iron pipe, class A, 6-in. and over, Birmingham, per ton	56.00
Cast-iron pipe, class B, 6-in. and over, Birmingham, per ton	55.00
Freight rates, iron and steel finished products, Pittsburgh to Pacific Coast points, carloads, per 100 lb.	1.25
Ferro-manganese, 70%, New York, per ton	250.00

Iron and Steel Scrap

(Maximum base-price f.o.b. consuming point, established by Iron and Steel Institute for quarter commencing July 1)

No. 1 heavy melting-scrap, per ton	$29.00
Cast-iron borings and machine-shop turnings, per ton	19.00
No. 1 railroad wrought, per ton	34.00

Fuel-oil, Asphaltum, and Bituminous Products

(Prices f.o.b. San Francisco, July 30)

Fuel-oil, 14 gravity, in bulk, per barrel	$1.60
Calol fuel-oil, 24 gravity (diesel-engine), in bulk, per barrel	1.85
Fuel-oil, 27 gravity, in bulk, per gallon	0.05
Calol paving asphaltum, D grade, in tank-cars, per ton	13.00
Calol paving asphaltum, D grade, in barrels, per ton	16.50
Calol paving asphaltum, E and L grades, in tank-cars, per ton	12.75
Oronite bituminous priming paints, in barrels, per gallon	1.00
Oronite roof-paint, in barrels, per gallon	0.50
Shingle-oil, in barrels, per gallon	0.215
Aroturps, in barrels, per gallon	0.245

Cement

(Prices f.o.b. San Francisco, July 30)

Portland cement, in sacks, carload lots, per barrel. $2.88

Subject to $0.05 per barrel cash discount and rebate of $0.10 each for sacks returned

Explosives

(Prices f.o.b. Giant, July 30, and subject to 2% cash discount)

40% nitro-glycerin, carload lots, per 100 lb	$22.75
40% nitro-glycerin, ton lots, per 100 lb	25.25
Judson powder, 20%, carload lots, per 100 lb	18.25
Judson powder, 20%, ton lots, per 100 lb	20.75
Giant stumping-powder, 20%, carload lots, per 100 lb.	15.00
Giant stumping-powder, 20%, ton lots, per 100 lb.	17.50
Black powder, 100-keg lots, per keg	2.30
Black powder, carload lots, per keg	2.00
'Blue-label' safety-fuse, less than 6000-ft. lots, per 1000 ft.	8.45
No. 6 blasting-caps, 1000 to 20,000 lots, per 1000.	16.66
No. 8 blasting-caps, 1000 to 20,000 lots, per 1000.	27.16
No. 6 electric blasting-caps, 10-ft. wires, less than 1000 lots, per 100	12.92

Non-Ferrous Metals

(Prices f.o.b. San Francisco, July 30)

Antimony (wholesale), per lb	$0.15
Copper, electrolytic, carload lots, per lb	0.26
Copper, electrolytic, small quantities, per lb	0.2735
Lead, pig, per lb	$0.083 to 0.093
Spelter, per lb	0.11

Lumber

(Mill prices per M.B.M. on douglas fir established by Fir Production Board)

Fir Common Boards, S1S or Shiplap

1× 2—6 to 20 ft. mixed lengths, S1S	$20.00
1× 3—6 to 20 ft. mixed lengths S1S	20.00
1× 4—6 to 20 ft. mixed lengths S1S	18.00
1× 6—6 to 20 ft. mixed lengths S1S or shiplap	18.50
1× 8—6 to 20 ft. mixed lengths S1S or shiplap	19.50
1×10—6 to 20 ft. mixed lengths S1S or shiplap	19.50
1×12—6 to 20 ft. mixed lengths S1S or shiplap	20.00

For selected common, add $3; for dressed and matched, add $1.50; for grooved roofing, add $3; for 16, 18, and 20 ft. only, add $2. Other orders for specified lengths, add $1 to above prices. No. 2 common boards and shiplap, $3 less when in stock.

Fir Common Dimension S1S1E

	6 ft.	8, 12, 14 ft.	16 ft.	9, 10, 18, 20 ft.	22, 24 ft.	26 to 32 ft.
2× 3, 2× 4	$17.50	$18.50	$19.50	$20.50	$21.50	$23.50
2× 6, 2× 8	17.50	18.00	19.00	19.50	20.50	22.00
2×10	18.00	19.00	19.50	20.00	21.00	23.00
2×12	18.50	19.50	20.00	20.50	21.50	23.50
2×14	....	21.00	21.00	22.00	23.00	25.00
2×16	....	22.00	22.00	23.00	24.00	26.00
2×18	....	24.00	24.00	25.00	26.00	28.00
2×20	....	26.00	26.00	27.00	28.00	30.00

Add $0.50 for every 2 ft. over 32 ft. up to 40 ft. For select common, add $3; S1E or rough, same mill base as dressed. For 2×4, 2×6, or 2×8 dressed and matched or shiplap, add to S1S1E, $1.50. Hemlock permitted in 2×4 and 2×6.

Fir Common Plank and Small Timbers S1S1E or S2S

	8, 12, 14, 16 ft.	9, 10, 18, 20 ft.	22, 24 ft.	26–32 ft.
3× 3, 3×4	$21.00	$21.50	$22.50	$24.50
3× 6	22.00	22.50	23.50	25.50
3× 8	22.00	22.50	23.50	25.50
4× 4, 4×6, 4×8	22.50	23.50	24.50	26.50
6× 6 to 8×8	22.00	23.00	24.00	26.00
3×10, 3×12	23.50	24.50	25.50	27.50
3×14	24.00	25.00	26.00	28.00
3×16	25.00	26.00	27.00	29.00
3×18	27.00	28.00	29.00	31.00
3×20	29.00	30.00	31.00	33.00
4×10, 4×12	23.50	24.50	25.50	27.50
4×14	24.50	25.50	26.50	28.50
4×16	25.50	26.50	27.50	29.50
4×18	27.00	28.00	29.00	31.00
4×20	29.00	30.00	31.00	33.00

Add $0.50 for every 2 ft. over 32 ft. up to 40 ft. For select common, add $3; S1E or rough, same mill base as dressed.

Coal

(Utah and Wyoming mine prices per ton fixed by the U. S. Fuel Administration)

Run-of-mine	$3.00
Prepared sizes	3.65
Slack or screenings	1.85

Freight-rates, Utah and Wyoming mines to San Francisco, carloads, $5.65 plus $0.15 war-tax per ton.

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Construction News Summary

STREET AND ROAD WORK

Boise, Ida.—State Highway Commission has awarded the following contracts for highway work:

Between the Salmon and Pahsimeroi rivers, 33 miles, to H. H. Boomer, Salmon, for $298,000.

Between Dickey and the Salmon river, 20 miles, to H. E. Cornell, Dietrich, for $65,000.

Between Mackay and Dickey, 18 miles, to Smith & Green, Boise, for $51,000.

Between Salmon river and Challis, 1⅛ miles, to Smith & Green for $5100.

Bremerton, Wash.—Contract for construction of 11,000 sq. yd. of concrete pavement on several streets, together with construction of sewers and watermains, has been awarded to R. H. Travers, Arcade Bdg., Seattle, for $55,170.

Chehalis, Wash.—Contract for construction of concrete sidewalks on several streets has been awarded to Albers & Son, Chehalis, for $9625. Simondson & Johnson bid $9973.

Colusa, Cal.—Contract for repairing and surfacing 1½ miles of the Arbuckle-College City road has been awarded to Brush-Howard Co., Santa Rosa.

Exeter, Cal.—Contract for paving several streets has been awarded to Federal Construction Co., San Francisco, for $111,000.

Fillmore, Cal.—Bids will be received until August 9 by C. Arrismith, city clerk, for construction of 109,000 sq. ft. of 4-in. concrete pavement with 1½-in. asphaltic wearing-surface. E. M. Lynch, Glendale, is engineer.

Glendale, Cal.—G. H. Oswald, O. T. Johnson Bdg., Los Angeles, was low bidder at $77,750 for construction of asphalt pavement on Broadway. Bryant & Austin bid $78,569 and G. R. Curtis $79,161.

Los Angeles, Cal.—City council has decided to construct highway on Terminal island.

Contract for grading and construction of concrete curbs and gutters on Burr avenue in road improvement district No. 140 has been awarded to J. W. Henderson and Hugh Cornwall, 104 South Howard street, Glendale, for $6982.50.

Madera, Cal.—Plans for paving 6th street have been completed and call for bids will be issued soon. Estimated cost is $39,054.75.

City trustees have decided to pave A street between Fifth street and Central avenue. Estimated cost is $13,234.38. Sloan & Robson, Nevada Bank Bdg., San Francisco, are engineers.

Martinez, Cal.—Contract for construction of divisions No. 7, 8, and 9 of the county highway system have been awarded to O'Brien Bros., Martinez, for $43,368; $66,466; and $49,080, respectively; unit prices being as follows: Division 7: concrete pavement, $7.44 per cu. yd.; wire-mesh reinforcement, $0.015 per sq. ft.; embankment, $0.80 per cu. yd. Division No. 8: concrete pavement, $7.94 per cu. yd.; wire-mesh reinforcement, $0.015 per sq. ft.; embankment, $0.80 per cu. yd. Division No. 9: concrete pavement, $7.60 per cu. yd.; wire-mesh reinforcement, $0.015 per sq. ft.; embankment, $0.80 per cu. yd. Bates & Borland bid on division No. 9, $6.50 for concrete pavement, $0.02 for wire-mesh, and $1.35 for embankment. County will furnish materials, but bidding prices include hauling materials from railroad.

County surveyor R. R. Arnold is preparing plans for construction of division No. 10 of the county highway system, extending from Martinez south-easterly through Franklin canyon, 4.9 miles. Call for bids will be issued early enough to permit completion of the grading this season.

Modesto, Cal.—Contract for paving D street between 9th and 14th has been awarded to D. C. Hartley, Modesto, at 3c. per sq. ft. for grading, 15½c. per sq. ft. for pavement, and 13c. per lin. ft. for header-boards.

Oakland, Cal.—Following bids were received for construction of road from Centerville to Irvington: Bates & Borland, $198,247.50; Oakland Paving Co., $245,055; Eaton & Smith, $247,260; Rogers & Osborn, $247,917.50. All bids were rejected, and plans will be revised before calling for new bids.

Contract for improvement of part of East 12th street has been awarded to Hutchinson Co., Oakland, at 52.5c. per ft. for concrete curbs, 16c. per sq. ft. for concrete gutters, 3c. per sq. ft. for grading, and 10.5c. per sq. ft. for oil-macadam pavement.

Contract for improvement of part of 35th avenue has been awarded to Hutchinson Co., at the following unit prices: grading, 2c. per sq. ft.; concrete curbs, 49c. per ft.; concrete curbs, 15c. per sq. ft.; oil-macadam pavement, 10c. per square foot.

Ogden, Utah.—Bids will be received until August 20 by B. Finch, acting district engineer, U. S. Office of Public Roads, for construction of the Ephraim-Orangeville road, 36.2 miles, requiring 150,000 cu. yd. common excavation, 42,000 cu. yd. rock excavation, 1800 cu. yd. rubble masonry, and 115,000 ft. B.M. bridge-timber.

Olympia, Wash.—Bids will be received until August 12 by State Highway Commission for construction of 8.3 miles of the Sunset highway between Creston and Wilbur in Lincoln county.

Olympia, Wash.—R. M. Hardy, Seattle, was low bidder at $96,727 for construction of 3½ miles of Pacific highway in Thurston county. James & Ward bid $103,537 and D. M. McGarry $106,968. Mr. Hardy was also low bidder on another 2½ miles of the highway in Thurston county at $72,521. D. M. McGarry bid $80,033. Concrete pavement is to be used on both divisions. Contract was awarded to Mr. Hardy at $141,000 for five miles of pavement.

Portland, Ore.—U. S. Office of Public Roads has approved Federal Aid road projects calling for Federal expenditures of $436,983.80 for construction during the coming fiscal year in Oregon. The amount available from Federal funds is $472,124.22, making the total amount available on a '50-50' basis, $944,248.44. The roads approved are as follows:

John Day highway in Wheeler county between Fossil and the Service Creek summit, 9.47 miles to be graded. Estimated cost is $36,733.40.

Elgin to top of Wallowa hill in Union county, 9.3 miles to be graded. Estimated cost is $36,094.30.

John Day highway in Grant and Wheeler counties from Service creek to Valades ranch, 48.45 miles to be graded. Estimated cost is $400,433.79.

Pacific highway in Marion county from Salem south to the county-line, 16.7 miles to be surfaced with bituminous macadam. Estimated cost is $359,546.

Old Oregon trail in Union county, 6 miles to be graded. Estimated cost is $13,917.75.

Baker to Cornucopia sag in Baker county, 4.9 miles to be graveled. Estimated cost is $41,926.50.

Yamhill to Nestucca in Yamhill county, 6.8 miles to be surfaced with gravel-macadam. Estimated cost is $81,-315.96.

Warren Construction Co., Portland, bid $403,453 for construction of bitulithic pavement on gravel base on Aurora-Salem highway and $421,438 for bitulithic on macadam. Burrell Engineering & Construction Co. bid cost plus 15%. Bids were rejected and work will be postponed until after the War.

Redwood City, Cal.—Bids will be received until August 12 by J. H. Nash, county clerk, for improvement of the La Honda road.

Contract for oiling streets in Wellesley park has been awarded to A. H. Kopperud, Oakland.

Riverside, Cal.—Contract for construction of concrete pavement on Hammer avenue near Corona, has been awarded to J. S. Miller, 1240 9th street, Santa Monica, for $4500.

Sacramento, Cal.—Bids will be received until August 12 by State Highway Commission for grading 15.9 miles of state highway in Shasta county between Tower House and Redding. Estimated cost is $203,000. This is a Federal Aid Road project. Work will require 155,000 cu. yd. excavation, 350 cu. yd. rubble masonry in retaining-walls, 100 cu. yd. dry-rubble masonry in retaining-walls, 1500 cu. yd. concrete in culverts and monuments, 9200 ft. 12 to 24 in. corrugated pipe, 2 miles new property-fences, 3.5 miles moving and re-setting property-fences, and 674 monuments. State will furnish reinforcing-steel, corrugated pipe, cement, and materials for new fences.

Bids will be received until August 19 by State Highway Commission for grading 2.75 miles of state highway in Marin county between Ignacio and Black Point.

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Bids will be received by W. F. McClure, State Engineer, Forum Bdg., Sacramento, until 12 noon, August 12, for construction of roads, walks, curbs, etc., at Los Angeles State Normal School; contractor to furnish material. Plans from State Department of Engineering, Sacramento.

Blanchard-Brown Co., San Francisco, was low bidder for construction of 2.8 miles of state highway through Rocklin and Penryn at the following unit prices: excavation, $1.50 per cu. yd.; 24-in. corrugated pipe, $2 per ft.; concrete in culverts and monuments, $14 per cu. yd.; concrete in pavement, $7 per cu. yd.; guard-rail, $0.45 per ft.; monuments, $2 each; a total of $29,983.50. A. J. Fairbanks bid $32,297. Engineers' estimate was $19,083.68. State will furnish reinforcing-steel, corrugated pipe, cement, sand, and coarse aggregate, valued at $15,389.40. All bids were rejected because too high.

O. G. Ritchie, San Francisco, was low bidder for construction of asphalt wearing-surface on state highway through Williams at $0.873 per sq. yd. or $9515.70 in all. Clark & Henery Construction Co. bid $11,772 and Blanchard-Brown Co., $11,990. Engineers' estimate was $7521. All bids were rejected because too high.

F. C. McIntire, Stockton, has been awarded contract for construction of 9.7 miles of state highway between Valley Springs and the easterly boundary of Calaveras county at the following unit prices: excavation, $1.05 per cu. yd.; 12-in. corrugated pipe, $0.80 per ft.; 15-in. pipe, $0.90; 18-in. pipe, $1; 24-in. pipe, $1.10; concrete in culverts and monuments, $20 per cu. yd.; monuments, $1.10 each; a total of $46,494.60. A. J. Fairbanks bid $49,919.70. Engineers' estimate was $49,339.14. State will furnish reinforcing-steel, cement, and corrugated pipe, valued at $5088.

A. L. McCray, Los Angeles, was low bidder for construction of 3 miles of state highway in Riverside county near Thermal at the following unit prices: excavation, $1 per cu. yd.; 18-in. corrugated pipe, $1 per ft.; concrete in culverts and monuments, $20 per cu. yd.; concrete in pavement, $9.25 per cu. yd.; monuments, $2 each; a total of $35,929.50. Johnson-Shea Co., Inc., bid $39,977. Engineers' estimate was $29,590.19. State will furnish reinforcing steel, cement, and corrugated pipe, valued at $12,-938.50.

M. Blumenkranz, Stockton, has been awarded contract for construction of 6.4 miles of state highway in Butte county between Oroville and the Shippee road at the following unit prices: excavation, $0.80 per cu. yd.; 12-in. corrugated pipe, $1 per ft.; 18-in. pipe, $1.25; 24-in. pipe, $1.15; concrete in culverts and monuments, $20 per cu. yd.; concrete in pavement, $5.90 per cu. yd.; guard-rail, $0.75 per ft.; monuments, $2 each; bridge across Northern Electric tracks complete, $8225; a total of $82,130.50. Engineers' estimate was $66,446.60. State will furnish reinforcing-steel, corrugated pipe, cement, sand, and coarse aggregate, valued at $34,486.

White & Gaskill, Long Beach, were low bidders for construction of 14.9 miles of highway between Merced and the easterly boundary of Merced county, at the following unit prices: excavation, $0.95 per cu. yd.; borrow excavation, $1.25; 12-in. corrugated pipe, $1 per ft.; 18-in. pipe, $1.50; 24-in. pipe, $2; concrete in culverts and monuments, $20 per cu. yd.; concrete in pavement, $5.90 per cu. yd.; moving and re-setting property-fences, $200 per mile; guard-rail, $1.25 per ft.; monuments, $2.50 each; a total of $128,678. Engineers' estimate was $97,281.95. State will furnish reinforcing-steel, corrugated pipe, cement, sand, and coarse aggregate, valued at $62,727.85.

Rogers Bros. Co., Los Angeles, was the only bidder for construction of 8 miles of highway in Monterey county between San Ardo and a point near San Lucas at the following unit prices: excavation, $1 per cu. yd.; 12-in. corrugated pipe, $1 per ft.; 18-in. pipe, $1.20; 24-in. pipe, $1.50; concrete in culverts and monuments, $15 per cu. yd.; concrete in pavement, $8.07 per cu. yd.; pile-jetty complete, $3000; riprap for retaining-wall, $6 per ton; slope-paving, $8 per cu. yd.; guard-rail, $1 per ft.; monuments, $3 each; a total of $97,818.32. Engineers' estimate was $58,851. State will furnish pipe-railing for culverts, reinforcing-steel, corrugated pipe, cement, sand, and coarse aggregate, valued at $55,002.

J. P. Moffitt, San Francisco, has been awarded contract for construction of 15 miles of state highway in Lassen county between Susanville and Coppervale at the following unit prices: excavation, $0.94 per cu. yd.; 12-in. corrugated pipe, $0.70 per ft.; 18-in. pipe, $0.85; 24-in. pipe, $1; concrete in culverts and monuments, $18 per cu. yd.; new property-fences, $230 per mile; moving and re-setting property-fences, $230 per mile; monuments, $1.15 each; a total of $72,296.70. Engineers' estimate was $66,827.08. State will furnish pipe-railing for culverts, reinforcing-steel, corrugated pipe, cement, and material for new fences, valued at $6950.20.

O. G. Ritchie, San Francisco, has been awarded contract for construction of 8.4 miles of state highway in Alameda county between Overacker's Corners and the southerly boundary of the county at the following unit prices: excavation, $1 per cu. yd.; 12-in. corrugated pipe, $1 per ft.; 18-in. pipe, $1; 24-in. pipe, $2; concrete in culverts and monuments, $14.50 per cu. yd.; concrete in pavement, $5.50 per cu. yd.; guard-rail, $0.45 per ft.; monuments, $1.50 each; a total of $84,976. Other bidders were Rogers Bros. Co., $88,073.50; Bates & Borland, $98,344; P. H. Hoare, $101,280; Blanchard-Brown Co., $112,488. Engineers' estimate was $85,168.20. State will furnish reinforcing-steel, cement, sand, coarse aggregate, and corrugated pipe, valued at $50,512.50.

George R. Daley, San Diego, was low bidder at $112,-500.20 for construction of 10.2 miles of state highway between a point near Bradley and the southerly boundary, but his bid was irregular. J. L. Conner, Los Angeles, was the lowest regular bidder and was awarded contract at the following unit prices: excavation, $0.90 per cu. yd.; 12-in. corrugated pipe, $0.75 per ft.; 18-in. pipe, $0.90; 24-in. pipe, $1; 30-in. pipe, $1.50; 36-in. pipe, $2; concrete in culverts and monuments, $15 per cu. yd.: concrete in pavement, $5.25 per cu. yd.; guard-rail, $0.70 per ft.; monuments, $1 each; a total of $114,751.70. George S. Benson & Sons, $129,940.30. Engineers' estimate was $105,240.41. State will furnish reinforcing-steel, corrugated pipe, cement, sand, and coarse aggregate, valued at $62,301.33.

No bids were received for surfacing with gravel 12 miles of state highway in Tehama county between Red Bluff and the northerly boundary.

Conners, Green & Co., Castella, were low bidders for construction of 1.2 miles of state highway near Dunsmuir in Siskiyou county at the following unit prices: excavation, $1.20 per cu. yd.; 12-in. corrugated pipe, $1 per ft.; 18-in. pipe, $1.25; 24-in. pipe, $1.50; concrete in culverts and monuments, $25 per cu. yd.; rubble masonry, $6 per cu. yd.; new property-fences, $400 per mile; moving and re-setting property-fences, $400 per mile; monuments, $2 each; a total of $19,417. A. J. Fairbanks bid $21,146.50. Engineers' estimate was $13,573.45. State will furnish cement, reinforcing-steel, corrugated pipe, and material for new fences, valued at $1699.58.

Estimated cost of construction of that part of the state highway lateral from Quincy to Oroville between Yankee Hill and Indian Falls by way of Feather River canyon is $1,003,400. Work will not be done until after the War.

State Highway Commission will construct highway from Biggs to Nelson by day-labor.

Contract for construction of 4½ miles of county highway from Freeport south has been awarded to Healy-Tibbitts Construction Co., San Francisco, for $53,136.20.

Salinas, Cal.—Granite Rock Co. was the only bidder for construction of the Salinas-Blanco road. Bid was rejected because too high.

Salt Lake City, Utah.—Contract for construction of 2-in. bitulithic pavement on 4-in. crushed-rock base on four miles of the Salt Lake City-Ogden road in Davis county has been awarded to Strange & Maguire, Salt Lake City, for $71,-548.70.

San Bernardino, Cal.—Contract for construction of three miles of concrete pavement near Cucamonga has been awarded to Johnson-Shea Co., Riverside, for $85,000.

All bids for improvement of Turner avenue have been rejected.

All bids for construction of three miles of concrete pavement on Hellman avenue near Cucamonga have been rejected and work will probably be postponed indefinitely.

San Francisco, Cal.—Board of Public Works has awarded the following contracts for street improvement:

Newton street between Morse and Brunswick to Fay Improvement Co., at 95c. per ft. for concrete curbs and 29c. per sq. ft. for asphalt pavement.

Fout avenue and part of Clarendon avenue to Thomas A. Clark at the following prices: retaining-walls, curb-armor, and back-filling, $4000; excavation, $1.50 per cu. yd.; embankment, $0.90 per cu. yd.; 10-in. pipe culvert, $2 per ft.; catch-basins, $100 each; moving catch-basins, $60 each; armored concrete curb, $0.80 per ft.; concrete sidewalks, $0.15 per sq. ft.; brick pavement, $0.42 per sq. ft.; asphalt pavement, $0.26 per square foot.

19th street between Third and Illinois to J. G. Harney at the following prices: excavation, $0.49 per cu. yd.; asphalt pavement, $0.22 per sq. ft.; concrete sidewalks, $0.13 per sq. ft.; granite curbs, $1 per ft.; 8-in. vitrified sewer, $0.80

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per ft.; wye-branches, $2 each; brick manholes, $79 each.

Lowell street between Mission and Hanover to Blanchard-Brown Co. at the following prices: excavation, $0.72 per cu. yd.; embankment, $0.24 per cu. yd.; concrete curbs, $0.72 per ft.; concrete sidewalks, $0.14 per sq. ft.; 8-in. vitrified sewer, $1.50 per ft.; brick catch-basins, $78 each; 10-in. culverts, $1.08 per ft.; brick pavement, $0.384 per sq. ft.; asphalt pavement, $0.21 per square foot.

28th avenue between Geary and Balboa streets has been awarded to James M. Smith, 407 11th street, San Francisco, at the following unit prices: excavation, $0.20 per cu. yd.; embankment, $0.20 per cu. yd.; asphalt pavement, $0.25 per sq. ft.; brick pavement, $0.41 per sq. ft.; concrete sidewalk, $0.14 per sq. ft.; concrete curbs, $0.75 per ft.; 10-in. culvert, $1 per ft.; 8-in. sewer, $2 per ft.; brick catch-basins, $90 each; brick manholes, $80 each; wye-branches, $1 each.

Division street between Utah and Ninth streets has been awarded to Fay Improvement Co. at the following unit prices: asphalt pavement, $0.258 per sq. ft.; granite curbs, $1.38 per ft.; brick catch-basins, $98 each; 10-in. vitrified culverts, $1.68 per foot.

Folsom street between Eugenia and Powhatan avenues has been awarded to Pacific States Construction Co. at the following unit prices: granite curbs, $1.40 per ft.; basalt-block pavement on concrete foundation with gravel filler, $0.49 per sq. ft.; asphalt pavement, $0.28 per square foot.

Army street from San Bruno avenue to Third street has been awarded to J. P. Holland, San Francisco, at $0.65 per cubic yard.

Board of Supervisors has decided to extend Market street as far as Caselli avenue.

Contract for paving pier No. 42 has been awarded to Raisch Improvement Co., San Francisco, for $8003.39.

San Jose, Cal.—Following bids have been received for the improvement of Fleming avenue: Gavin & Griffin, $10,487; F. H. Ritchie, $11,500; John F. Adams, $11,587.99; Bernard Ransome, $11,759. Engineer's estimate was $9990. All bids were rejected because too high.

Following bids have been received for improvement of the Senter and Coyote road: Bernard Ransome, $29,867; F. H. Ritchie, $31,500; Raisch Improvement Co., $31,520; Gavin & Griffin, $31,975. Engineer's estimate was $31,485.

Following bids were received for improvement of the Almaden road: F. H. Ritchie, topeka surface, $65,000; plain concrete, $48,000; Bernard Ransome, topeka surface, $70,000; oil-and-screening surface, $53,500; plain concrete, $47,000; Raisch Improvement Co., topeka surface, $66,300; oil-and-screening surface, $55,928; plain concrete, $49,778. Engineer's estimate was $69,146 for topeka surface, $72,830 for warrenite surface, $48,860 for plain concrete, $53,340 for oil-and-screening surface, and $46,495 for oil-macadam. All bids were rejected because too high.

San Luis Obispo, Cal.—Following bids were received for improvement of Marsh street: Clark & Henery Construction Co., grading and paving, 20c. per sq. ft.; concrete curbs, 65c. per ft.; Municipal Improvement Co., pavement 31.25c.; curbs, 58c.; Hugh Connor, pavement, 29.5c.; curbs, 70c.; Federal Construction Co., pavement, 30c.; curbs, 60c. All bids were rejected because too high and work will probably be postponed until after the War.

Santa Barbara, Cal.—Contract for paving Montecito street between State and Milpas streets has been awarded to Fairchild-Gilmore-Wilton Co., Los Angeles, for $42,228.52.

Contract for improvement of Canal street between Micheltorena and Valerio streets and Arrellaga street between Canal street and the Pueblo line has been awarded to Fairchild-Gilmore-Wilton Co., Los Angeles, for $12,731.

Seattle, Wash.—Contract for construction of permanent highway No. 18 from Kent toward Orilla, 2.31 miles, has been awarded to J. A. Fletcher Co., Luzerne Apartments, Seattle, for $58,455.20. Kaiser Paving Co. bid $64,314.34 and R. M. Hardy, $64,500. Engineer's estimate was $57,979.43.

Alfred Ehlgren was the only bidder at $6999 for construction of Franklin Depot road. Bid was rejected.

All bids for improvement of North and West 76th street have been rejected because too high and work will be readvertised. Engineer's estimate was $27,040.

Contract for improvement of 13th avenue and other streets has been awarded to D. H. Traphagen for $84,705.

South San Francisco, Cal.—Contract for grading and construction of concrete curbs, sidewalks, and gutters on tract owned by South San Francisco Land & Improvement Co. has been awarded to C. J. Lindgren, Hillsborough, for $13,000.

Stockton, Cal.—Contract for improvement of Coulterville road at Spring Gulch has been awarded to Joseph Musante for $1385. Richard De Ferrari bid $1430 and A. M. Gookin, $1480.

All bids for improvement of Stanislaus and American streets between Main and Weber streets have been rejected because the funds available are not sufficient for the work.

Tulare, Cal.—Contract for construction of concrete pavement on 2.3 miles of streets has been awarded to J. E. Lee, Pasadena, for $38,102.

Ventura, Cal.—Bids will be received until August 8 by J. B. McCloskey, county clerk, for improvement of several streets in and adjoining the city of Fillmore, requiring 223,000 sq. ft. of 4-in. concrete pavement with 1½-in. asphaltic wearing surface. Plans from county surveyor upon deposit of $3.

Contract for paving Main street and Ventura avenue, requiring 190,000 sq. ft. of 4-in. concrete pavement with 1½-in. asphaltic surface and 4100 cu. yd. excavation has been awarded to Fairchild-Gilmore-Wilton Co., Los Angeles, for $29,806.01. T. E. Hill & Co. and Bryant & Austin also bid on this work.

Visalia, Cal.—Contract for construction of concrete highway between Visalia and Klink has been awarded to White & Gaskill, Long Beach.

Willows, Cal.—Bids will be received until August 9 by W. H. Sale, county clerk, for construction of one mile of highway with 'solidite' surface in district No. 1.

Yreka, Cal.—Federal Government will improve road down Klamath to Seiad, about 50 miles, to permit hauling chrome in motor trucks. County will contribute $10,000 to this work.

SEWERS AND DRAINAGE

Los Angeles, Cal.—Joseph D. Zaich, Los Angeles, was low bidder at $28,799 for construction of vitrified-pipe sanitary sewers on Main street between Florence and Slauson avenues.

Salt Lake City, Utah.—Contract for construction of sewer on Sunnyside avenue has been awarded to M. Palm for $2413.22.

Wolf Point, Mont.—Contract for construction of sewer system has been awarded to C. H. Kelley, Kalispell, for $17,583. Other bidders were Two Miracle Construction Co., $18,262; Security Bridge Co., $21,120; G. Nordquist, $22,647.

BRIDGES AND CULVERTS

Chehalis, Wash.—Contract for construction of two bridges has been awarded to A. C. Sears, Winlock, for $6421.

Colfax, Wash.—Contract for construction of two bridges, one at Colton and the other at Farmington, has been awarded to H. C. Malott, Seattle, for $12,985 and $3790, respectively.

Eureka, Cal.—Contract for construction of bridge on state highway near Garberville has been awarded to Padgett & Kelly, Eureka, for $7975. Frank L. Smith bid $8750 and W. F. Notley, $11,125.

Contract for construction of bridge on state highway across south fork of Eel river six miles from Garberville has been awarded to Padgett & Kelly for $35,000. Frank L. Smith bid $39,750 and Mercer-Fraser Co., $43,900.

Everett, Wash.—Contract for construction of Ebey Island trestle has been awarded to Kaiser Construction Co., Everett, for $13,843.

Lewiston, Ida.—Contract for construction of two reinforced concrete bridges on the North and South state highway in Nez Perce county has been awarded to the Security Bridge Co., Lewiston, for $9580.

Martinez, Cal.—A. J. Grier bid $15,970 and Hyde, Harjes & Co., $22,422 for construction of the Taylor Slough bridge. On account of the bids being considerably more than the estimate, they will probably be rejected and a ferry operated instead.

Napa, Cal.—Contract for construction of concrete bridge on state highway across Metcalf creek has been awarded to Henry Thorsen, St. Helena, for $3365. George Errington and Charles Gildersleeve also bid on this work.

Oakland, Cal.—Bids will be received until August 12 by George E. Gross, county clerk, for repairing the Webster Street bridge across the estuary. Estimated cost is $47,000.

Contract for construction of pile-and-frame trestle from foot of Dennison street to Government island has been awarded to Healy-Tibbetts Construction Co., San Francisco, for $38,041.

Olympia, Wash.—Contract for construction of steel

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bridge across the Naches river on the McClellan Pass highway has been awarded to C. G. Huber, Central Bdg., Seattle, for $26,388.

Oroville, Cal.—County surveyor Martin Polk is preparing plans for reinforced concrete bridges on the state highway. The main bridge across the Feather river at Oroville will cost $125,000 and there will be ten smaller bridges costing in all $25,000.

Red Bluff, Cal.—Contract for construction of the Ox Bow bridge has been awarded to Charles McCartney, Red Bluff, for $8874.

Contract for construction of Champlin Creek and Toomes Creek bridges has been awarded to Bordwell & Zimmermann, Napa, for $38,000.

Redding, Cal.—Contract for construction of two 100-ft. bridges across Churn creek has been awarded to D. E. Albers, Santa Rosa, for $15,000.

Contract for construction of reinforced concrete bridge across slough at Balls Ferry has been awarded to William Stephens, Redding, for $14,827. Bridge consists of fifteen 20-ft. spans.

Sacramento, Cal.—W. M. Ledbetter, Los Angeles, was the only bidder and was awarded contract at $49,750 for construction of a reinforced concrete bridge on the state highway across the Arroyo Honda near Gaviota in Santa Barbara county, containing one 85-ft., one 78-ft., and three 96-ft. spans. Engineers' estimate was $54,685.31.

W. M. Ledbetter was the only bidder at $11,551 for construction of a reinforced concrete bridge on the state highway in Santa Barbara county near Orella, containing two 41-ft. spans. Engineers' estimate was $8726.25. Bid was rejected and new bids will be received until August 12.

Contract for construction of six reinforced concrete bridges in Shasta county across Sulphur, Boulder, Churn, Salt, Moody, and Spring Branch creeks has been awarded to De Waard Bros., San Diego, for $25,373.

C. H. Gildersleeve, Berkeley, was low bidder and was awarded contract at $8985 for construction of reinforced concrete bridge on state highway across Outlet creek in Mendocino county. Other bidders were Macrae & Layaz, $12,844; A. H. Vogt, $16,800; Erickson & Peterson, $21,150; August Finoe and Giacomo Piai, $22,980. Engineers' estimate was $9007.50. State will furnish cement and reinforcing-steel, valued at $4657.20.

Contract for construction of two reinforced concrete bridges across Slate creek on state highway in Shasta county has been awarded to De Waard Bros., San Diego.

San Jose, Cal.—Bids will be received until August 19 by H. A. Pfister, county clerk, for construction of a reinforced concrete bridge on the Roberts road over Los Gatos creek. This bridge is to be built jointly by the county and by the town of Los Gatos.

Contract for construction of five reinforced concrete bridges on the Pacheco Pass road has been awarded to Sam Sciarino, San Jose, for $13,242.42. Other bidders were J. W. Williams, $14,950; W. Radtke, $17,000; A. Mattson, $18,695; Bos & O'Brien, $20,957. Engineer's estimate was $15,675.

Contract for construction of reinforced concrete bridge across Coyote creek at East Santa Clara street, which was awarded to Eaton & Smith, has been assigned to Thomson Bridge Co., San Francisco.

Santa Barbara, Cal.—Contract for construction of three bridges over Orcutt creek has been awarded to W. N. Ledbetter & Co., Los Angeles, for $10,330. Engineers' estimate was $10,850.

Contract for construction of stone bridge over Cold Spring creek has been awarded to A. Roqui for $4243. Peter Poole bid $4750. Engineer's estimate was $4900.

Seattle, Wash.—Contract for reconstruction of the Holgate Street bridge for the Northern Pacific Railway Co. has been awarded to Pearson Construction Co., Seattle, for $65,000.

Ventura, Cal.—Contract for construction of reinforced concrete culvert at Somis has been awarded to T. E. Hill & Co., 1158 West 52nd street, Los Angeles, for $3335.

Yreka, Cal.—Contract for construction of a reinforced concrete bridge across the Shasta river between Montague and Yreka has been awarded to A. L. Lamb, Montague, for $9980.

Contract for construction of concrete bridge near Fort Jones has been awarded to A. L. Lamb for $3100.

IRRIGATION AND WATER SUPPLY

Anderson, Cal.—Special tax of $45,000 for completion of irrigation system in Anderson-Cottonwood irrigation district has been defeated. The system is complete except for one or two laterals at the southern end of the district, and these will probably be left unconstructed until after the War.

Esparto, Cal.—All bids for construction of water system at Esparto have been rejected and work will be done by day-labor under the supervision of county surveyor A. G. Proctor.

Merced, Cal.—Petition for election on the question of forming a large irrigation district embracing land on the western side of the valley in Merced, Stanislaus, and Fresno counties has been denied by the Board of Supervisors because the number of names on the petition was insufficient.

Monrovia, Cal.—Contract for trenching and back-filling for new municipal water system has been awarded to R. F. Ware, Marsh-Strong Bdg., Los Angeles, at 9c. per ft. for 12,250 ft. of 16-in. pipe and 7c. per ft. for 6000 ft. of 8 and 12-in. pipe.

Newport Beach, Cal.—Formation of Newport Mesa irrigation district has been ratified at election. A. H. Smith, W. S. Williamson, and Donald J. Dodge have been elected directors. Plans include well, pumping plant, and reinforced concrete reservoir.

Palmdale, Cal.—Formation of irrigation district containing 5000 acres in this vicinity was ratified at election. H. C. Fertig, John E. Jones, and E. H. Davis are directors.

San Diego, Cal.—City engineer George Cromwell is preparing plans for earth dam with concrete face in Powder House canyon. Estimated cost is $14,965.

Thomas Haverty, Los Angeles, was the lowest bidder at $13,400 for construction of water system at naval coaling station at La Playa. Other bidders were Henry Clarke, $13,543; Keene Construction Co., $13,600; Walter Slater, $14,780; C. H. Julian, $17,399; and Fred Heilbron, $18,997.

San Francisco, Cal.—State Water Commission has received the following applications for permission to divert water for irrigation:

Horace L. Hill, Los Altos, 15 second-feet from Sacramento river in Yolo county. Plans include pumping-plant. Estimated cost is $3500.

Guilbert A. Jones, Yreka, water from spring. Plans include small concrete dam and pipe-line 1100 ft. long.

U. S. Reclamation Service, Orland, 250 second-feet from Stony creek. Plans include concrete and rock-fill dam, enlargement of 5.8 miles of old canal, and construction of 17.44 miles of new canal. Estimated cost is $2,200,000.

U. S. Indian Service, Los Angeles, ½ second-foot from creek in Riverside county. Plans include pipe-line and concrete dam. Estimated cost is $2000.

Russell C. Jensen, Reno, 9 second-feet from streams in Sierra county. Estimated cost of work is $9000.

Scobey, Mont.—Contract for construction of sewer and water systems has been awarded to G. W. Kemper, Mindot, North Dakota, for $109,431. Other bidders were C. H. Kelly, $112,000; Security Bridge Co., $114,509; W. D. Lovell, $121,432.

LIGHT, HEAT, AND POWER

Bishop, Cal.—Contract for construction of transmission line 55 miles long and telephone line 11 miles long for the Nevada-California Power Co. has been awarded to Fred L. Somers, Pomona, for $70,000. Both lines will have wooden poles.

Los Angeles, Cal.—Capital Issues Committee has approved project for construction of ornamental lighting system on Broadway. Estimated cost is $92,000.

Olympia, Wash.—Contract for construction of heating plant at State School for Girls at Grand Mound has been awarded to Appling-Griggs Co., Tacoma, for $23,789.

San Francisco, Cal.—State Railroad Commission has granted permission to Ontario Power Co. to construct hydroelectric plant in the San Antonio canyon. Estimated cost is $64,551.

Washington, D. C.—Bids will be received until August 12 by Bureau of Yards and Docks, Navy Department, for construction of extension to power-plant at Pearl Harbor, Hawaii. Estimated cost is $150,000.

RIVER AND HARBOR WORK

Alameda, Cal.—Contract for dredging on estuary for Rolph Shipbuilding Co. has been awarded to American Dredging Co., San Francisco, for $27,000.

Newport Beach, Cal.—Contract for dredging channel at harbor has been awarded to Pope Shipbuilding & Construction Co., Title Insurance Bdg., Los Angeles, for 20c. per cubic yard. Estimated cost is $50,000.

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